Urban Endemics

Creating Urban Environments to Protect Imperiled Species

Jodi Allen Sagvold

URBAN ENDEMICS

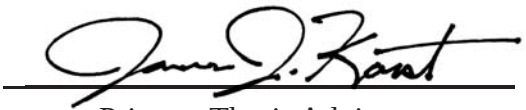
Protecting Imperiled Species

A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University

By:

Jodi Allen Sagvold

In Partial Fulfillment of the Requirements
for the Degree of
Bachelors of Landscape Architecture



Primary Thesis Advisor

Thesis Committee Chair

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TABLE OF CONTENTS:

THE THESIS ABSTRACT

Abstract:

This thesis project will explore the requirements for a botanical garden and associated grounds, within the city of Fargo, North Dakota. A key element includes the addition of micro-climates suitable for the introduction/ re-introduction of native species which are threatened or could become threatened by loss of habitat. This project will also focus on methods of educating the public on recent advancements in land planning options with the goal of connecting fragmented habitats. These connections encourage healthier genetics and increased reproduction rates for at-risk species.

Thesis Problem Statement:

To prevent the loss of Imperiled species, could the introduction (or re-introduction) of these endemics into urban environments be a viable method to increase habitat for at-risk species?

What methods have other communities employed in protecting their localized loss of habitats?

STATEMENT OF INTENT

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The Project Typology:

Botanic Garden, Conservatory, Greenhouses, Habitat for threatened plant and insect species, Education Center, and Community Gathering Place

The Theoretical Premise/Unifying Idea:

This thesis will explore how human population growth has caused the drastic loss in some species' numbers. This research will be analyzed to find alternatives for designing urban spaces to educate the respective community while providing habitat to ensure land availability for these "forgotten" species.

STATEMENT OF INTENT

The Project Justification:

Located one hour Southwest of Fargo, North Dakota, the Sheyenne National Grassland contains 30 rare, protected, or endemic (found in only one region) species in a fragmented 70,000 acre preserve. The Prairie Fringed Orchid and the Dakota Skipper Butterfly are in particular danger as their numbers drop due to fragmented habitat. By re-creating ecosystems for these species within a city setting, an awareness to stewardship and belonging may help to educate viewers to make a commitment to a more responsible, sustainable lifestyle, while setting aside space for struggling species to call home.

The Claim:

A new landscape approach to preserving biological diversity must be implemented if society intends to prevent species from becoming endangered in the first place. Concepts which have led to fragmentation of natural habitats can be replaced by new land planning methods centered on a core of preserving declining ecological communities.

THE PROPOSAL

THE PROPOSAL

NARRATIVE:

While growing up in the Northern portion of the Sheyenne National Grasslands, I had always felt a connection to the diverse wildlife present. I was suprised to learn many years later of the rare, endangered, and protected species which also called this region home. Having watched urban sprawl take more rich farmland and wetland habitat in the name of "progress", I wonder why more isn't being done to prevent their accelerated loss.

In my travels, I have been privileged to visit both reclamation sites and botanical gardens such as the Allerton Gardens, of the Hawaiian Island of Kaua`i; and the Fairchild Tropical Botanical Garden in Miami, Florida. When comparing these locales to new developments in Fargo, I noticed a lack of habitat being provided for North Dakota's rare or struggling species.

4 of the 5 existing buildings on the proposed site are designed in this red, Colonial, barn-like style including the largest, this two-story main building. Photo by: Jodi Sagvold

The roots of this proposal are elements which already comprise large portions of Fargo's land. Therefore, it would require fewer resources to return project related sites back to their natural states.

How then does one create interest in these places? Taking what makes a region special and showcasing the rare and interesting aspects of it has been a success for the Allerton Gardens, and can be translated to North Dakota's unusual ecosystems in the same manner. In this case, a fen/wetland reclamation area containing rare native plants, such as several of North Dakota's fourteen native orchid species.

A fen is a groundwater fed stream system which comprises of low land covered wholly or partially with water or boggy land. These unique ecosystems provide important habitat for many threatened native species of North Dakota.

The proposed site location in North Fargo is also already embedded in the local population, as it was until recently the Trollwood Performing Arts center. Bounded on three sides by the Red River of the North, this North Fargo park lies primarily in a floodplain and can therefore offer experiences which other sites cannot, such as changing views of a flooding fen system bounded by flood water every spring.

Combine this with the option for viewing unusual non-native species in simulated environments such as greenhouses and a tropical plant conservatory, and the similarities between the tropics and North Dakota's ecosystems becomes more evident. Adding a Botanical Garden to the list of sights to see while visiting Fargo will provide visitors with one more tourist destination as well.

In addition to walking paths, outdoor garden rooms, and indoor spaces to observe flowering plants in winter, rentable gathering spaces for social events would be integrated into the design to draw more visitors to the botanical garden. This would provide further income to aid maintenance costs.

Vegetable and flower gardens would provide living classrooms for those interested in gardening workshops, and additional income from the sale of fresh produce, canned goods such as pickles and jams, cut flowers, and a Spring plant sale. A kitchen and dining facility in the existing main building would provide catering to the botanical garden hosted events and festivities such as weddings, anniversaries, political speeches, and office parties.

USER/CLIENT DESCRIPTION:

Designed for local residents and international visitors alike, this botanical garden represents an entertainment option for all who are interested in strolling through formal and informal gardens for relaxation, photography, bird-watching, or education. Native habitats and ecosystems represented provide habitat for wildlife viewing, while gardens provide information and design options for those interested in creating their own urban garden. Finally, the new tropical plant conservatory provides the option of stepping out of the prairies and into a tropical oasis for an easy get-away without leaving the city.

Owned and operated by the city of Fargo, the botanical garden would be self-funded through gate admissions, venue rentals, donations and fund-raising events. Plant and produce sales, both on-site and with the local Farmers Markets, provide added income and community involvement.

Opportunities exist for volunteer work options. A Master Gardeners program would ensure an added work-force through required community service hours.

Major Project Elements:

- Concrete viewing deck and promenade for Spring flood viewing

- A large glass-enclosed, temperature/humidity controlled Tropical (USDA Plant zone 9-10) plant conservatory

- Habitat for insect (butterfly) and orchids in the form of tall-grass prairie, violet grove, and wetland/fen

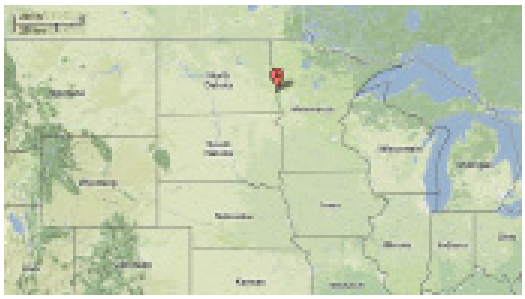
- Existing buildings on site to be renovated to provide class-rooms and rentable “Events” rooms

- Restrooms already located on site to be evaluated and possibly upgraded

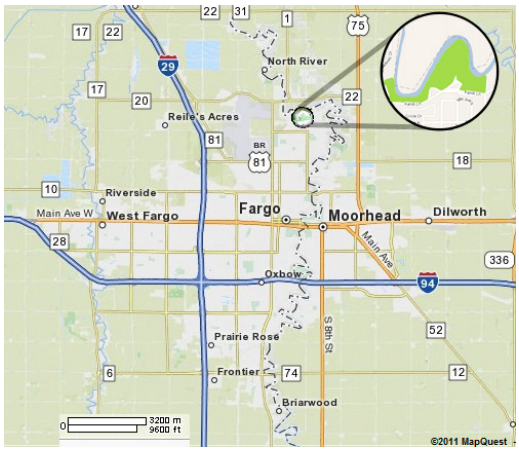
- Two production/supply greenhouses

- Outdoor gazebos, pergolas, boardwalks, retaining walls, trellises, fountains, sculptures, and other elements to be added in stages

SITE INFORMATION:



Fargo, North Dakota



Located in Fargo, North Dakota at the former Trollwood Performing Arts Center, this botanical garden site is found just North of 35th Avenue North, off North University Drive.

The site extends Northward and is bound on the West, North, and East by the Red River.

Revitalization of the Trollwood neighborhood becomes a separate mission, as the removal of structures previously used by the Trollwood Performing Arts Center, has left this neighborhood in a transition mode and with loss of identity.

The Red River in Winter Photo: by Jodi Sagvold

The former Trollwood site also meets other requirements for a project of this scope such as its frequency to flooding, access to river views, steep topography, and a storm water channel in which water can be naturally purified in constructed wetland habitats for release back into the waterway.

Image: GoogleEarth.com

Radiating from the botanic garden, sites such as many of the Interstate cloverleaf systems can be transformed from Kentucky Blue grass into specific ecosystems. Each site will be altered to host a specific native specie and its ecosystem.

PROJECT LOCATION:
Fargo, North Dakota

The Census Bureau defines the Fargo Metropolitan Area as comprising all of Cass County, North Dakota and Clay County, Minnesota. The metropolitan area has a population of 208,777, according to the 2010 census, up from 174,367 from the 2000 census.

The city's largest suburb of West Fargo has nearly doubled in the last six years and this trend is expected to continue. The growth of the city has boosted the local economy and set the area apart from national trends such as rates of home foreclosure and declining home sales.

North Dakota saw a population increase of + 4.7% from the years 2000 - 2010.

Cass County, with a population of 149,778. saw an increase of + 21.6% from the years 2000 - 2010.

Fargo Population:
105,549

Metro Area:
208,777

www.census.gov

Photos: by Jodi Sagvold

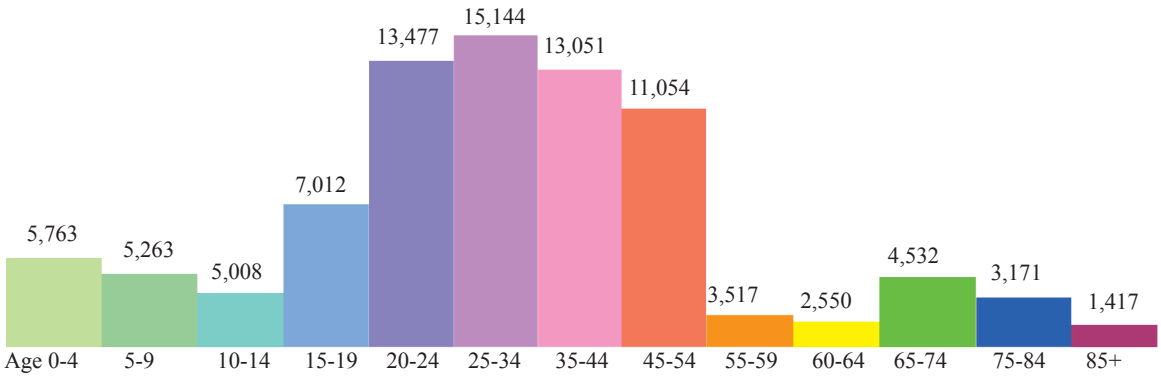
SITE INFORMATION: Fargo at regional scale

City: Fargo, North Dakota
Population: 2010 census, 105,549 people, + 16.5% growth
Rank: North Dakota's largest city
Metro Population: 2010 census, 208,777 people (Cass and Clay County)

Census Data courtesy http://2010.census.gov/2010census/data/

Fargo's Main Ave. Depot Photo: by Jodi Sagvold

Fargo Metro Area population by age bracket



Project Emphasis:

1. To provide much-needed habitat for threatened species of plants and insects, by re-creating unique habitats within an urban setting

2. To allow for an educational environment

3. To rejuvinate a slowly declining neighborhood which has recently lost its identity with the loss of a performing arts theatre

4. To aid in storm-water purification while providing wetland habitat

A Plan for Proceeding:

Research will be conducted in the following areas:

1. The Theoretical Premise/Unifying Idea
2. Project Typology
3. Historical Context
4. Site Analysis
5. Programmatic Requirements

A Plan of Design Methodology:

1. Mixed method quantitative/qualitative analysis
2. Graphic Analysis
3. Digital Analysis
4. Interviews

Mixed Method, Quantitative Qualitative Approach:

I. Concurrent Transformative Strategy:
   a. The strategy will be guided by the theoretical premise/unifying idea.
   b. Implementation: Both quantitative and qualitative data will be gathered concurrently.
   c. Priority will be assigned by the requirements of the theoretical premise/ unifying idea.
   d. Integration of the data will occur at several stages in the process of the research and will depend on the requirements of the examination of the theoretical premise.
   e. Analyzing, interpreting, and reporting of results will occur throughout the research process.
   f. It will be presented in both text and graphics.

II. Quantitative Data, including but not limited to:

1. Statistical Data:
   a. Gathered and analyzed locally or obtained through an archival search.

2. Scientific Data:
   a. Measurements obtained through instrumentation and or experiment: Gathered directly or through an archival search.

III. Qualitative Data:

1. Gathered from direct observation
2. Gathered from a local survey
3. Gathered through an archival search
4. Gathered from direct interviews

A Plan for Documenting the Design Process:

I. Documentation includes but is not limited to digital archive of photos, sketches, design drawings, video, audio interviews, etc. with back-up discs.

II. Preservation is dependant upon disc copies (and online documentation?)

III. Permission is given to NDSU to provide access for continued study, as well as online access.

IV. Presentation of this material is to follow Thesis guidelines and will be an oral presentation with digital imagery.

V. Collection of information reguarding inventory, analysis, design process, etc. to be paced according to stage developement and projected timelines are to be used as a system of weekly goals.

Previous Studio Experience:

LA 271, Fall Semester 1997, Professor Julie Meyers
Plaza design stressing the use of form vocabulary and context.

Miami Plaza
Chicago Plaza
Plains Art Museum Plaza

LA 272, Spring Semester 1998, Professor Joshua Walter
Exercise in learning AutoCAD

Greenacre Park
Rabanus Park Interpretive Center
Thompson School Design

LA 371, Fall Semester 1998, Professor David Meyers
Urban Design Studio

Parking Lot Design, Fargo, ND
Greenway Design, Grand Forks, ND
NDSU Technology Park, Fargo, ND

LA 372, Spring Semester 1999, Professor Tim Kennedy
Residential Planning Studio

Community Planning and Design, Lakota, ND
Masonry Competition, Fargo, ND

Previous Studio Experience - Continued

LA 471, Fall Semester 1999, Professor Dennis Colliton
Urban Planning Studio

Dike East, Fargo, ND
Richfield, MN

LA 472, Spring Semester 2010, Professor Stevie Famulari
Phytoremediation Studio

Acid Canyon, Los Alamos, NM

LA 571, Fall Semester 2010, Professor Catherine Wiley
Environmental Conservancy Planning Studio

Sheyenne National Grasslands, ND
Bison Re-Introduction Study
Planning and Designing Potential Habitat

PROGRAM DOCUMENT

RESEARCH RESULTS AND GOALS

Theoretical Premise Research:

A.) Department of Botany, Centres of Plant Diversity

According to the Centres of Plant Diversity (CPD) website, “The primary cause of loss of plant diversity in North America is the habitat destruction resulting, ultimately, from the continuously increasing human population. Even publicly owned, “protected” areas (federal, state, local) are constantly being subjected to various uses that are detrimental to the conservation of biodiversity. Residential, industrial and agricultural development, with the consequent alteration and loss of habitat, is the primary threat associated with rising population. Additional threats include invasive plant and animal species, fires and ecologically unsound fire suppression, logging, mining, pollution (including pesticides), recreational land use, alteration of drainages, filling in of wetlands, road building, maintenance of utility rights-of-way, plant collecting for the domestic and international trade (especially cacti, carnivorous plants, ginseng and orchids) and insufficient or faulty management practices” (Davis 1997).

“Grassland is perhaps the most extensive and varied vegetation formation of the North American continent” (Barbour and Billings 1988).

National and Regional Flora

- The flora of North America North of Mexico consists of approximately 20,000 vascular plant species in approximately 2350 genera (Morin, unpublished data) and 210 families (Thorne 1993). Two families, Leitneriaceae and Limnanthaceae are entirely endemic to the area; another two, Simmondsiaceae and Fouquieriaceae, also extend into Baja California and Sonora in Mexico.

- About 900 genera are endemic or nearly endemic to this area (some extend into Mexico) (Takhtajan 1986).

- It is estimated that approximately 4198 (est. 20%) plant species are endemic to North America (N. Morin 1995, pers. comm.).

- "Of 1,200 plant species in North Dakota, 850 can be found on the Sheyenne Grasslands, such as the threatened western prairie white-fringed orchid and the beach heather."(www.ransomcountynd.com)

Even today, despite long human actvity, grassland still covers more than 125 million ha in the U.S.A. Climate is a major determinant of grassland and grassland type, it being characterized usually by a wet-season/dry-season regime and temperature and precipitation extremes. The three major types of prairies are tall-grass, mixed-grass, and short-grass, the latter being the steppe grasslands of the high plains. All are dominated by grass and grass-like species, but also have a rich assemblage of forbs associated with them (Risser, 1985). Risser estimates that North American grasslands contain 7500 plant species. The Great Plains flora contains about 3000 taxa" (Great Plains Flora Association 1986).

North America, A Regional Overview

Natural Vegetation: Major types include coniferous forest, tundra, temperate deciduous forest, grassland (prairie), desert, and subtropical vegetation
Number of vascular plants: c. 20,000 species.
Number of endemic species: c. 4198 (est. 20%).
Number of genera: 2350.
Number of endemic genera: 900 (or nearly endemic).
Number of vascular plant families: 210.
Number of endemic families: 2.
Important plant families: Gramineae, Leguminosae, Pinaceae, Rosaceae, Ericaceae, Cucurbitaceae.

Grasslands

The grasslands that once dominated central North America have been greatly reduced through extensive overgrazing, agricultural development and fire suppression. Fire has played a significant role in the development and maintenance of grasslands by, for example, suppressing the encroachment of trees and shrubs and by reducing competition from invaders such as Poa pratensis and Bromus inermis. It also improves the palatability and nutritional value of forage. Although they harbour relatively few endemics and lack high species diversity, the grasslands are very important for their value as watershed, forage and habitat for large numbers of domestic and wild animals and are the home of species of realized, or potential food crops (Sims 1988). Grasslands are the principal agricultural lands of North America; only 1% of the original prairie ecosystem is still intact (Barbour and Christensen 1993).

Grassland comprises several major associations:

* The tall-grass prairie
* The mixed-grass prairie
* The short-grass prairie
* Desert grassland
* California grasslands or Pacific prairie
* The Palouse prairie

Wetlands

Wetlands are not a specific vegetation formation but they are of considerable conservation concern. Only half of the original wetlands in the U.S.A. remain, and 1300 km² of wetlands are being lost through agriculture and construction every year (N. Morin 1995, pers. comm.). Draining of wetlands is one of the most severe threats to biodiversity on the continent, endangering species and threatening the existence of some vegetation types.

Rare plant species

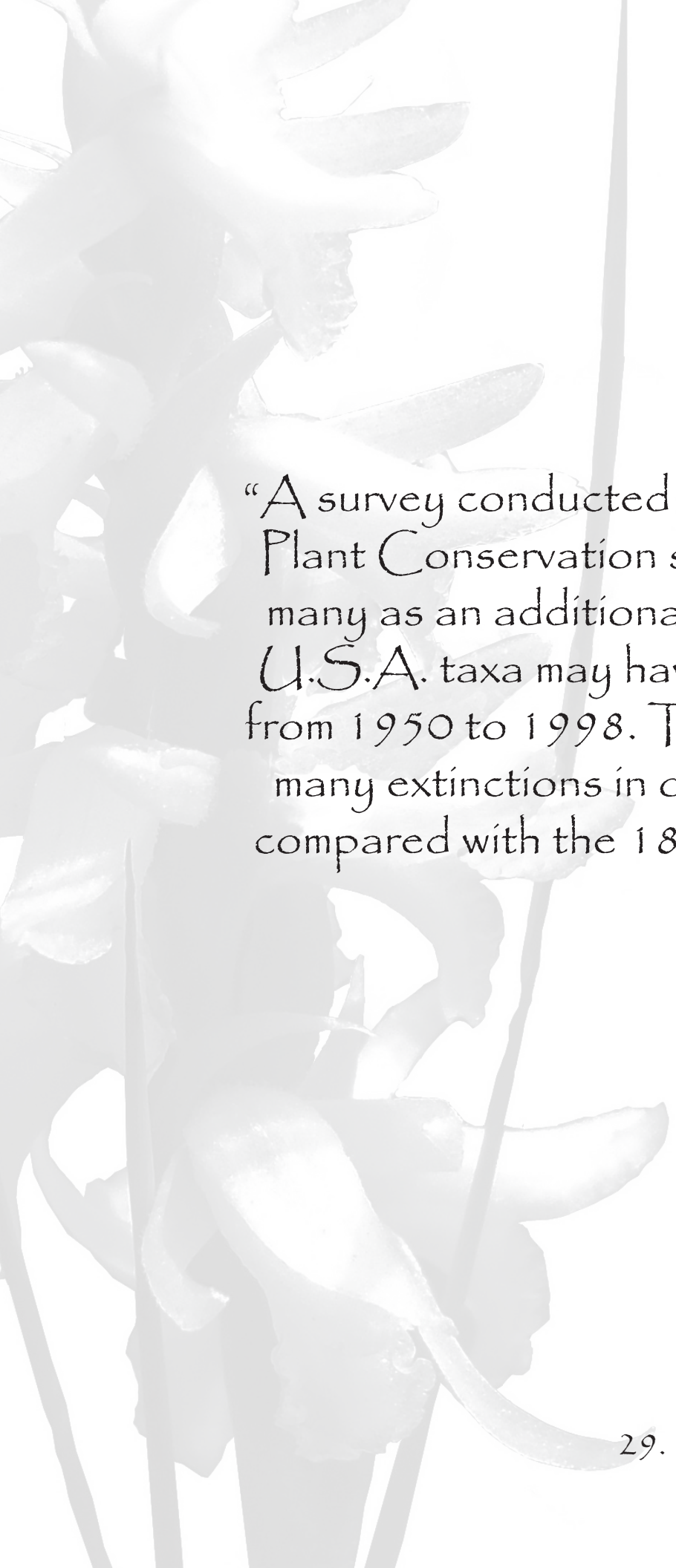
About 10% of the species in the flora of the U.S.A. (Elias 1977) are considered to be endangered or rare. About 90 plant species became extinct in North America between 1800 and 1950 (Yatskievych and Spellenberg 1993). A survey conducted by the Center for Plant Conservation suggested that as many as an additional 475 continental U.S.A. taxa may have become extinct from 1950 to 1998. This is five times as many extinctions in one-third the time compared with the 1800-1950 period.

Conservation

Federal agencies concerned with conservation and land management in the U.S.A. include the United States Fish and Wildlife Service (responsible for enforcing the Endangered Species Act and for habitat conservation, especially of wetlands), the United States Forest Service, the Bureau of Land Management and the National Park Service. There is no comprehensive inventory of U.S.A. native plant species or community diversity on which to base management and land-use decisions. Therefore, in 1993, the National Biological Survey was established to undertake research aimed at biological and ecosystem monitoring.

The Flora of North America project derives from the deep interest that botanists have in studying and characterizing the plants of the region and the need for authoritative information for basic and applied research, conservation, and resource management. Ever since explorers first sent North American plants to Europe, the world has known that the flora is rich and interesting.

The first accounts of plants from the area were published in Europe by European botanists (e.g., in Robert Morison's Historiae [1680--1699], Leonard Plukenet's Phytographia [1691--1705], and John Ray's Historia Plantarum [1686--1704]), and the first attempt at production of a comprehensive flora of the continent was undertaken by John Torrey and Asa Gray the 1830s.



"A survey conducted by the Center for Plant Conservation suggested that as many as an additional 475 continental U.S.A. taxa may have become extinct from 1950 to 1998. This is five times as many extinctions in one-third the time compared with the 1800-1950 period."

CPC website

B.) Architecture Minnesota; *Natural Environments, Twin Cities Metropolitan Area* - Seminary Fen

"In the early years of the environmental movement, land-protection advocates concentrated on saving vast tracts of remote wilderness. Today, creekbeds, ravines, marshes and woodlands in the midst of metropolitan communities--places endangered by encroaching development--are being saved by local activists who find land-protection challenges sometimes literally in their own backyards."(Roscoe, 2002)

Protection of natural spaces has shifted from a focus on expansive, majestic scenic areas to remnant woodlands, fens, and wetlands. These areas are perhaps less photogenic, but more significant to the natural environment because of water filtration, storm-water retention, and diverse species habitats which occur there.

The woodlands and prairies that once isolated the Twin Cities metro area's early settlements, are now mostly discontinuous pockets of nature surrounded by "hard-shelled civilization". (Roscoe, 2002)

According to the Sierra Club North Star Chapter's *Citizens' Guide to Endangered Green Spaces*, published in 2001,

"Only 3.6 percent of land in the seven-county metro area still holds native-plant communities". A study completed in 1998 by the Minnesota Department of Natural Resources indicates only six percent of the metro area is a high-quality natural environment of woods, prairie, wetlands, or river corridors. A subsequent DNR mapping study overlays many of those natural areas with patterns of proposed development.

The Sierra Club's *Citizens' Guide* also notes fens may be Minnesota's rarest wetland type and perhaps the rarest wetland type in North America. Seminary Fen, pictured below, is threatened by proposed road construction that could restrict underground water flow and thus forever damage the fen's biological integrety. As Fargo's urban sprawl begins to resemble that of the Twin Cities, it is important to compare the effects which urban sprawl has left on these ecosystems to what may happen to Fargo's.

www.watersheddistrict.org

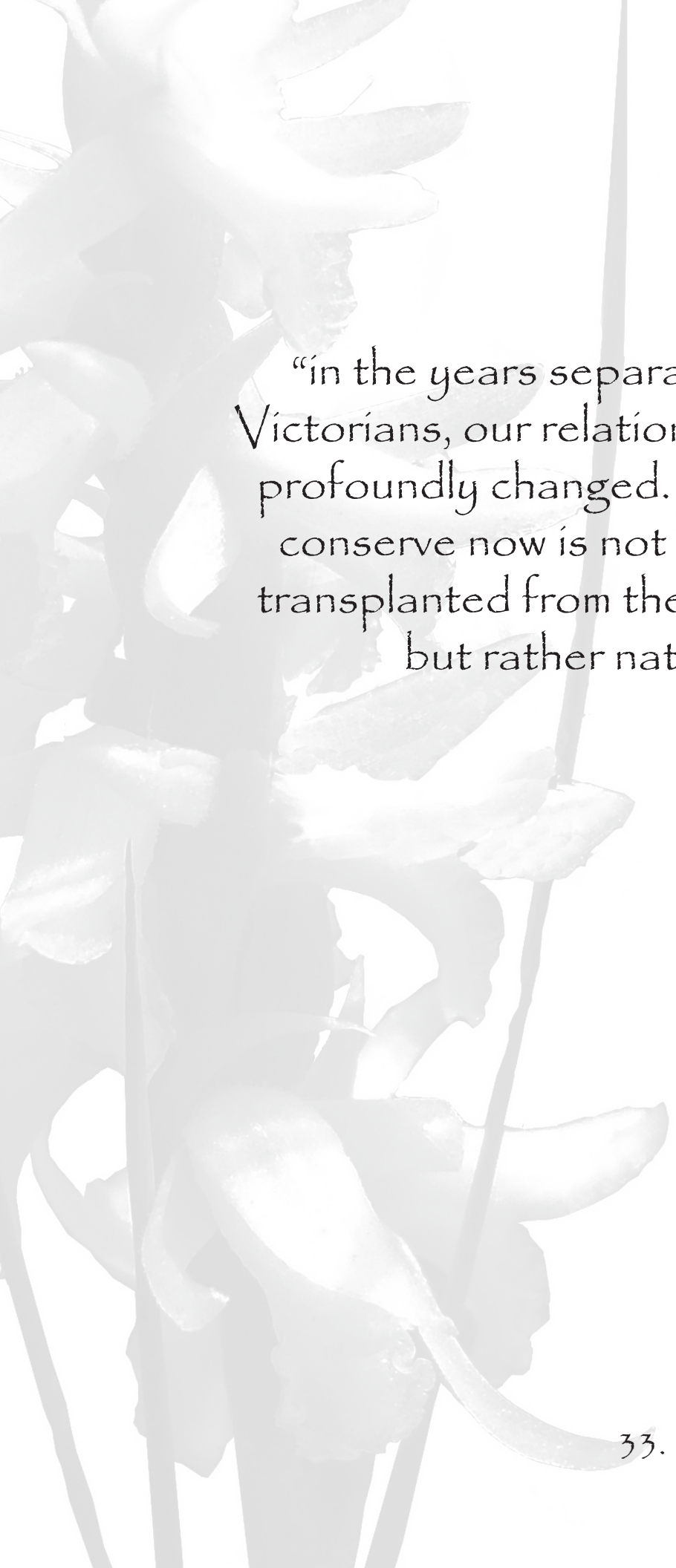
C.) Crystal Palaces: Garden Conservatories of the United States

Whether the glasshouses are high-tech wonder-constructions, or modest remodels of old neighborhood favorites, they continue to collect and display plants with a sense of urgency. *The New York Times* summed it up on May 1, 1997, when describing the opening of the Enid A. Haupt Conservatory: *"in the years separating us from the Victorians, our relationship to nature has profoundly changed. What we seek to conserve now is not individual plants, transplanted from their native habitats, but rather nature itself."*

- Glasshouses across the country are official rescue sites for endangered plants seized by government agencies intercepting them from smugglers.

- Conservatories convey their messages, whether environmental, artistic, or educational, in various ways and at different levels. Just about every conservatory gives school tours and provides interactive learning opportunities for children, as well as youth gardening programs.

- Renewed public interest and support for conservatories around the country proves that this approach to exhibits, both formal and informal, is successful.



"in the years separating us from the Victorians, our relationship to nature has profoundly changed. What we seek to conserve now is not individual plants, transplanted from their native habitats, but rather nature itself."

New York Times, May 01, 1997

Conservatory at Como Park, St. Paul, Minnesota Photo by Jodi Sagvold

Although many conservatories still adhere to the classic Victorian horticultural principles, many others, both old and new, have embraced a new botany, with an emphasis on ecological association and plant conservation. These are the cutting-edge topics of landscape architecture, and in many ways they are most adequately tested in the conservatory. Take a look at places like the Sibley Horticultural Center at Callaway Gardens in Georgia or the new Rio Grande Botanic Garden Conservatory in New Mexico. Radical, but subtle, changes are taking place here-changes that will one day alter the face of the American landscape. People want to learn not just about the newest varieties of rosa, but about bigger ideas, such as how natural systems operate or how ecosystems are interconnected.

The conservatory is a centerpiece of this movement.

A Brief History

Conservatories:

The first greenhouses were built in ancient Rome using thin sheets of semitransparent mica rock as glazing. Like traditional coldframes, the squat structures sunk into the earth to protect fragile plants. Early greenhouses served utilitarian purposes such as overwintering fruiting plants and with the development of modern glassmaking and the production of structural metals, personal conservatories, greenhouses, and orangeries sprung up around Europe. Gradually conservatories became a focal point of the garden itself, evolving into architectural statements of beauty. Even George Washington's estate at Mount Vernon boasted a greenhouse.

The glasshouse was imported to this country from England in the latter half of the nineteenth century, although many other European nations, including France and Germany, had long-standing traditions of building conservatories. But it was the English model that appealed to American tastes, specifically those conservatories that were most simple in their style and ornamentation and yet grand in their purpose "because they gave even the poorest soul access to the wonderment of nature. Conservatories were democratic".

At the turn of the century, and up to the Depression, conservatories were seen as a part of the civic repertoire of libraries, ball-fields, and parks. During and after the Second World War, interest began to fade. The 1960's saw a resurgence, but the 1990's is when conservatories really began to boom. Today, you find most every conservatory has a public education mission.

In the nineteenth century the mass production of iron and steel accelerated architectural possibilities, giving rise to larger and more expansive conservatories. Computers led to space-age aesthetics during the 1960's as seen in Milwaukee's distinctive Mitchell Park Domes. The use of concrete framing revolutionised designs like Denver's Boettcher Memorial Conservatory.

Mitchell Park Horticultural Conservatory - Milwaukee, Wisconsin, U.S.

Structure:

Garden conservatories are some of the most difficult public buildings to design and maintain. The misty level of 90 percent humidity that benefits tropical plants simultaneously wilts people and wreaks havoc on structural materials and paint. Construction codes and requirements of the Americans with Disabilities Act present challenges to landscape architects trying to recreate a natural jungle; yet clever solutions abound. Perhaps the greatest experiment taking place in today's conservatories has to do with finding economical and environmentally sound means for climate control. Modern conservatories have incorporated such innovations as passive heating and passive cooling.

In the 1960's plastic emerged as an alternative to glass, but quickly proved inadequate as it turned yellow under hot sun and corroded from contact with chemical fertilizers and joint adhesives. Plexiglas was installed in St. Louis' Climatron® Conservatory, but needed to be replaced after 20 years. Laminated, heat-strengthened glass has been successfully used in the Lucille Halsell Conservatory in San Antonio. The successful use of a combination of double-glazed laminated glass in Brooklyn's Steinhardt Conservatory has driven architects to now constrain themselves to linear forms as to return to using glass rather than plastic alternatives.

Heating vast amounts of space with only glass as an insulator is an uphill battle. Modern conservatories rely, at least partially, upon sophisticated automated controls to regulate atmosphere, air flow and temperature. The Lucille Halsell Conservatory's central computer communicates with two sensors located in each room every sixty seconds, taking temperature and humidity readings then sending the average back to the central computer. Simultaneously, an outside weather station checks wind speed and direction, rainfall, and light intensity. The computer then coordinated the sensor readings and sets into motion whatever action is necessary to reach the programmed targets. Most conservatories find that evaporative cooling cells, combined with high-powered fans, attain a comfortable medium between the needs of plants and those of the visitors. Air-conditioning is usually installed only in lobbies, restaurants, and gift shops. Misting devices such as the Mee Fog System help tropical plants thrive.

Occasional city regulations for conservatories already call for collection and reuse of run-off water that flows down drains under normal watering conditions. More aggressive solutions can be found, and Como Park's conservatory in St. Paul seems to have one of the best. At the time of their 1998 renovation, they designed special gutters into the structure to collect as much as twelve thousand gallons of rainwater in underground cisterns, then pump it back for use in the conservatory.

Even though computers can operate complex watering systems, conservatories of all sizes prefer to water some displays by hand in order to give each plant the precise amount of moisture it needs under variable daily conditions. City water supplies often carry more chemicals than many plants, particularly those gathered from the wild, can tolerate. In addition to collecting rainwater, conservatories look for other ways to avoid chemically treated water, such as ionization or the reverse-osmosis system used in the Bolz Conservatory in Madison, Wisconsin.

Exhibits:

In the last decades of the twentieth century a new emphasis on imitating actual ecosystems took hold at many conservatories, where plants are arranged according to climatic zone and interdependent associations. One example of this trend is the recently refurbished Enid A. Haupt Conservatory at the New York Botanical Garden. This classic Victorian structure was restored faithfully to its 1900 origional, while inside a revolution took place, where traditional glasshouse fare was replaced with a more flowing organization, much like an ecosystem itself. As part of this new approach to design,many conservatories take a proactive stance toward educating their audiences about the environment.

Exhibits of threatened tropical species such as Theobroma cacao become more meaningful when visitors realize that someday the source of chocolate may be extinct.

Support and production houses are just as important as the part of the conservatory seen by the public. Talented gardeners bring plants to perfection in auxiliary greenhouses before they go on display. Some exhibits, such as orchids, rotate almost daily so that visitors see only plants in bloom. The standard ratio is about three support houses for each conservatory, as overproduction is necessary if the public is to see only the best.

Often, tropical birds, reptiles, turtles, and insects such as butterflies or ladybugs are kept within the conservatory as a natural method of keeping harmfull insects under control without the use of pesticides.

www.thegirlintheredsweater.com

E.) Wetlands in the United States: Soil Classification

Wetland soils are now being classified according to the new soil classification scheme developed by the U.S. Soil Conservation Service, Soil Survey Staff. Much of the descriptive material published before 1973 predates the new soil and wetland classifications.

Organic soils are natural bodies that occur in peatlands as a result of the accumulation of plant remains in a water-saturated environment. In the new classification scheme, organic soils have been defined as soils that are either saturated with water for long periods or are artificially drained. They consist of: (1) at least 18% organic carbon if the solids fraction is 60% or more clay; or (2) have at least 12% organic carbon if clay is absent; or (3) have between 12 and 18% organic carbon if the clay content is less than 60% (U.S. Soil Conservation Service, Soil Survey Staff, 1973).

Prior to 1973, an organic soil was arbitrarily defined as a soil that is at least 30cm thick and contains at least 20% organic matter. In the new scheme, a soil is considered to be organic if half of the uppermost 80cm is organic and has a moist bulk density greater than 0.1 g cm $^{-3}$. There is no thickness requirement if the organic materials rest on rock or fragmental lithic materials whose interstices are at least partially filled with organic materials.

As of 1942, there were 90 English terms applied to peatlands, peat, peat-like, etc. This has undoubtedly increased since then. In addition to European terms (e.g., fen, bog, mire) there are local terms (e.g., swamp, marsh, prairie, pocosin, glade), each of which appears in literature, but with different meaning among authors.

Of all the terms, “wetland” is now the one most commonly used by the general public when referring to inland ecosystems with standing water. A wetland is identified by the presence of vegetation typically adapted to life in saturated soils.“Swamp” and “Marsh” are sometimes used interchangeably and as a synonym of “Wetland”. Twenty basic wetland typed are recognized.

North Dakota falls in the North-Central and Northeastern States Region. The climate in this region has a strong zonal pattern with the Northernmost belt being Type VI (VIII) Humid (Boreal). Mean annual temperatures range from about 2 to 11˚C. The average annual freeze-free period varies from 100 to 160 days.

Topography and soils in this region have been greatly affected by Pleistocene glaciation. Drumlins, moraines, eskers, glacial lake basins, glacial river valleys, and ice-block depressions occur in this region. Pedogenic parent materials include tills, stratified drift, lacustrine clays, and many rock types. Lakes and ponds are very common in this region, as well as abundant wetlands that vary in size, sediments, hydrology, chemistry and vegetation.

Two of the most frequently used terms applied to organic soils are peat and muck. Peat is a type of organic soil with plant remains that have undergone very little decomposition and can be identified as one of the following five types.

1. Shagnum moss peat, having at least two-thirds Shagnum moss fiber

2. Hypnum moss peat, containing at best one-third fiber material, of which at least half is Hypnum moss fiber

3. Reed-Sedge peat, having at best one-third fiber material, of which at least half is non-moss fiber

4. Peat Humus, containing less than one-third fiber

5. other peat, which includes all other types of peat

Muck is a type of organic soil that is decomposed to the degree that identification of plant structures is impossible. This distinction between peat and muck is not absolute, however, and neither term plays a major role in current soil classification, as peat humus is designated as a synonym for muck.

RESEARCH SUMMARY

Research Summary:

While restoration of habitat may prove an easier task than starting from scratch, creating the right soil and moisture conditions for certain plants can still be a challenge. When looking at the native orchids of North Dakota, it is easy to see the difficulty in providing one ecosystem which would meet the needs of all. While some prefer more acidic conditions under dense canopy, others prefer calcareous soils in full sun. Planning for extended stages of the project seems to be the right method of procedure for a project of this magnitude.

Stage 1:

Many portions of the botanical garden could be implimented early on. Construction and completion of the conservatory and associated glasshouses would "extend" the season of this Northern climate and provide an identity to the gardens long before the new plantings mature.

Exterior vegetable and annual gardens would be an easy starting point for the showcase gardens. Autumn seed collection and tuber and half-hardy bulb overwintering and division (i.e. Dahlias, Gladiolus, Elephant Ear) would ensure easy expansion of the gardens at a minimal cost. Collection of seeds for the Heirloom garden would begin through purchase, donations, and trade. While this process will continue throughout all stages, the continued gathering of seed from the garden's first aquisitions builds a healthy seed stock for the new season.

Stage 2:

The concrete bed of the stream channel would be removed during the dry months of summer. Soils would be analyzed for species' compatability. Maple, Elm, Linden, Wild Grape, and Prairie Rose currently grow well on the upper banks of this surface run-off channel, indicating mesic to calcareous, moist woodland environment with streambed as a target biome for this small channel. Inlet restoration may include shrubs, sedges, and herbaceous plants.

Portions of the site which would not be impacted by the construction phases could be installed, primarily perennial, shrub, and tree plantings.

Repurposing of existing structures would begin, including rentable venue space, kitchen, classrooms, restrooms, office space, labs, and storage among other uses.

Stage 3:

Existing trees on the low lands of the site would be evaluated and many marked for removal. Much of this area consists solely of Hybrid Poplar and Green Ash, many planted in rows. Hybrid Poplar proves to be a relatively short-lived species, which may disturb the freshly installed wetland if they required early removal. Green Ash are currently being removed in the city of Fargo as a combative measure against the fast spreading Emerald Ash Borer. This insect is responsible for the loss of most of the Ash trees from Michigan to Minnesota, and is predicted to do the same to Fargo's Ash species within five years according to Fargo's Forestry Department.

Niobe Weeping Willow, though not native, would be evaluated for its erosion control properties as most of the Willow on site are found within a short distance of the river. A few mature Bur Oak trees are found on the lower portion of the site, and would be saved to serve as a starting point to creating a small Oak Savannah.

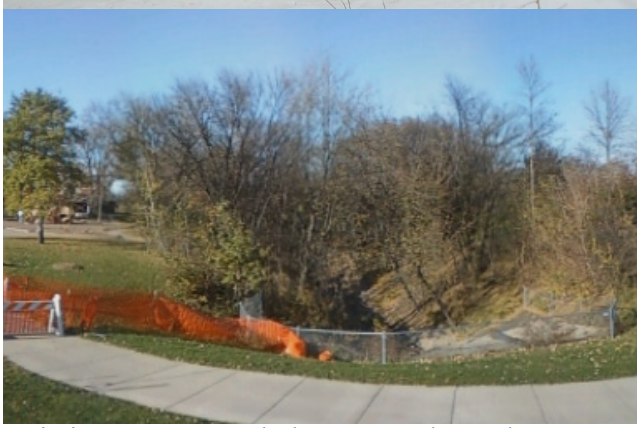
Stage 4:

The construction of the fen and wetland system would begin after the removal of undesired trees. A compacted clay basin would serve as the base for a small reflection pond near the conservatory. A sand-dune system of soil is to be placed over the clay, providing a porous stratum for overflow water to trickle through.

Several landowners within the borders of the Sheyenne National Grasslands (SNG) provide the service of selling sand by the cubic yard. Using healthy "living" sand containing associated microbes and fungus would aid in the developement of healthy plants which depend on these associations for proper mineral absorption. Reeds and other wetland species will be introduced as erosion control and to prepare the soil, and the harder to aquire native species such as orchids and the Adder Fern would be introduced after this soil preparation regiment.

Photo by Patrick Benson, 2010 SNG trip

Stage 4:



Existing -concrete clad-Stream Channel
Photos: by Jodi Sagvold

The placement of this water system atop a large, gradually sloping hill, would provide a minimum maintenance stream which requires only regulating the flow of water into the pond, as gravity does the rest. The water could be obtained directly from the Red River, and as the fen system empties its volume back into the river via the wetland, filtration would occur. This would provide not only habitat, but a living classroom for educational purposes.

A healthy natural (culvert fed) stream and fen of the Sheyenne National Grasslands, Fall 2010

The image to the left shows a similar stream channel. This one empties into the Sheyenne River in the Sheyenne National Grasslands. Much of the woody vegetation consists of Pussy Willow, Red Osier Dogwood, Wild Prairie Rose, Clematis vine, Wild Grape vine, and Quaking Aspen. The mounded formations of the stream bed offer varied ecosystems which are allowed to interact in a relatively small space.

Typological Research Results

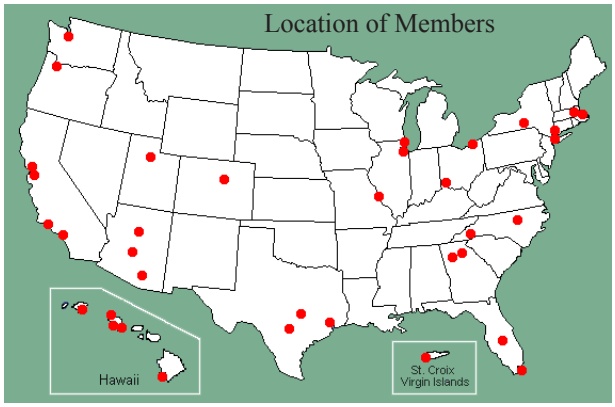
Glasshouse/Conservatory:
Though difficult to design and maintain, many references imply that the addition of a conservatory into a botanic garden is a benefit for these reasons:

- gives the user a central focal point
- provides necessary environments to maintain a more prolific planting display
- creates nostalgia for the viewer
- protects struggling species in a controlled environment
- illustrate how ecosystems are interconnected

Case Study: Center for Plant Conservation

America's flora is at risk. Today nearly 30% of the flora in the United States is considered to be of conservation concern. Without human intervention, many of these plants may be gone within our lifetime. Eighty percent of the at-risk species are closely related to plants with economic value somewhere in the world, and more than 50 percent are related to crop species.

The Center for Plant Conservation has 36 botanical institutions. Participating institutions gain access to the CPC website (centerforplantconservation.org). Access is limited to conservation staff at CPC institutions, CPC satellite offices, and other close affiliates.



Criteria for Membership in CPC

A CPC institution is one that has taken on significant responsibility for conserving and maintaining rare taxa in the National Collection through ex-situ work, research (field or lab research supporting theoretical or applied ex-situ or in-situ restoration needs), stewardship and land management, or fieldwork (monitoring, restoration, augmentation and reintroduction). CPC institutions are expected to undertake and work cooperatively with others towards public education involving its mission, plant conservation issues, and the process of restoration and recovery for rare taxa.

Institutions will be judged to qualify for admission based on the following criteria:

1. The institution must be a non-profit organization, and exempt from federal income taxes under Section 501 (c) (3) of the Internal Revenue Code.

2. The institution must provide approval of the application from an official with over sight authority for the organization (Board of Trustees, University President, or equivalent).

3. The institution's mission must formally include conservation, and their programs must include work with regionally rare taxa of conservation concern.

4. CPC institutions must use quality, science-based principles and recognized best con servation practices in their rare plant work.

5. The institution must explicitly agree to the standards, protocols, and reporting outlined in the current CPC Handbook, which is periodically updated as necessary, and represents CPC's required best conservation practices, as derived through the advice and participation of scientists within the network, the scientific advisory council, agency cooperators, and peer reviewers.

6. The institution must demonstrate the capability and commitment in quality of professional staff and administrative structure to conduct their conservation program in a manner that documents and collects meaningful data using high quality scientific standards.

7. The facility must have adequate equipment, space, availability of materials, and supporting infrastructure to conduct a quality program.

8. The institution must have staff with a significant portion of their job duties and work time dedicated specifically to plant conservation activities. The majority of this core staff (and support budget for them) should be a part of the institutions base budget, not supported solely with short-term grant funds.

9. The institution should have adequate computer support for plant conservation staff for record keeping, and support work, as well as Internet access to facilitate communication with the National Office and collaboration with other institutions in the CPC network.

10. The institution must demonstrate willingness to provide support for conservation officers and directors to frequently attend annual meetings and training identified as helpful for the quality and development of the conservation program.

Not all member institutes are botanic gardens.

Waimea Valley, Hawaii
Photo by Jodi Sagvold

Waimea Valley in Kauai'i, Hawaii is a large canyon system where many rare plants are found. Possibilities exist for the inclusion of the Sheyenne National Grasslands of North Dakota to be treated in the same manner.

Fairchild Tropical Botanic Garden
Photo by Jodi Sagvold

The addition of a botanic garden in Fargo, North Dakota would help to ensure membership by providing added educational and research benefits. Many of the 36 members of CPC are well-developed botanic gardens such as the Fairchild National Tropical Botanic Garden, located just South of Miami, Florida.

Case Study: Creating an Urban Wetland - Video (2007)

Whites Creek, Sydney, Australia

“As urbanization increasingly encroaches on the natural environment, progressive designers in modern cities are looking at innovative ways to manage urban public space.”

This is a non-traditional approach to stormwater management, community involvement, environmental education and behavioral change. It’s aim is to demonstrate that constructed wetlands within an urban setting can successfully provide:

- Wildlife Habitat
- Recreation areas
- Environmental Education
- A sense of community ownership
- Stormwater pollution management
- An overall softening of the urban landscape -

and works as a tool for professionals in: Urban Planning,Landscape Design, Environmental Science and Engineering, Sustainable Design and Designers in governments and local councils

Images: top right, Portion of master plan - Whites Creek, Sydney, Australia; bottom left, shortly after instillation; bottom right, same location with mature plants

"These multi-functional corridors tie together people and recreation while using natural water treatment technology and encouraging biodiversity."

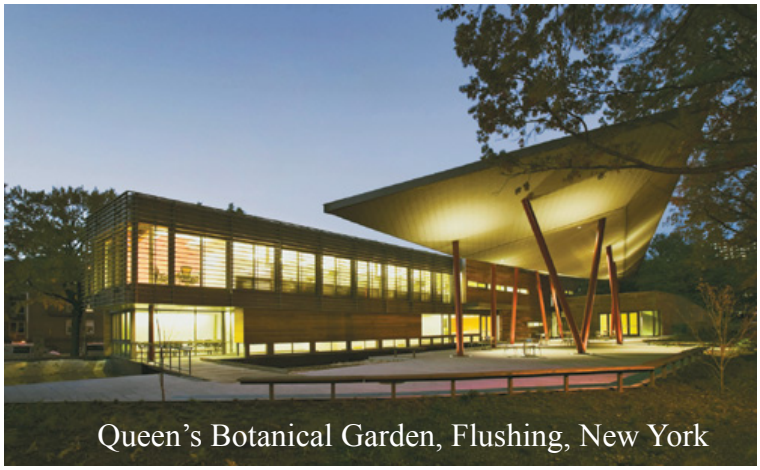
Creating an Urban Wetland - Video (2007)

Water plays an important role in maintaining life on our planet. The symbiotic relationship it has with life forms is bound in complex eco-systems. We have only recently begun to appreciate the integrated role water plays and the importance of maintaining the natural water cycle. To fully understand how a healthy water system works, we must look at the geomorphology of natural water systems.

In nature, porous surfaces allow for ground water aquifers to recharge. Nature presents special benefits when it slows the flow of water to almost stagnate levels. In doing so, it creates ponds and wetlands that allow water to be utilized by plants, insects, and animals. The natural ecosystems allow for complex processes that filter, purify water, encourage biodiversity, and create healthy habitats.

Modern humans are starting to realize that by maintaining our synergistic relationchip to nature, we raise the quaity of our lives as well as the other life forms we share this planet with. By using the natural water systems as our inspiration, we are able to address a possible solution to manage our water in the urban setting. Green spaces crucial to wild-life migration, bring environmental benefits and allow city dwellers to integrate nature into their hectic lives. Residents of an inner city suburb of Sydney, Australia, successfully lobbied their council to restore the natural water cycle for a small part of Whites Creek channel. In doing so, they transformed an abandoned, weed infested parcel of land along side an open concrete canal into a living freshwater wetland with several sustainable benefits.

Case Study: GreenSource - Queens Botanical Garden
Flushing, New York


Queen's Botanical Garden, Flushing, New York

When it rains, water is captured from a folded canopy over the building's entry plaza and falls into a catchment area below. This dramatic display is one indication that water and the design that carries it, was a key consideration for the design team in shaping the center and the surrounding landscape.

KEY PARAMETERS

LOCATION: Flushing, New York (Flushing Meadows)
GROSS SQUARE FOOTAGE: 15,831 ft2 (1,470 m2)
COST: $12 million (bldg. and adjacent landscaping only)
COMPLETED: September 2007
ANNUAL PURCHASED ENERGY USE (BASED ON SIMULATION): 41 kBtu/ft2 (469 MJ/m2),
ANNUAL CARBON FOOTPRINT (PREDICTED): 12 lbs. CO2/ft2 (60 kg CO2/m2)
PROGRAM: Visitor center, auditorium, administrative offices

In addition to the winglike canopy, the center is made up of a two-story building clad in western red cedar, housing a reception area, meeting rooms, and offices. A partially underground reinforced-concrete structure contains an auditorium and is covered with a green roof planted with sedum, grasses, and perennial flowers. Separating the two elements is a water-filled channel that visitors encounter as they enter the building, passing over it on a small bridge to reach the reception area.

The channel is part of a much larger and very visible storm-water management system that collects runoff, cleanses it with aquatic plants, and keeps it out of the city's overtaxed combined sewer-and-wastewater infrastructure.

Naturally, water was not the only concern of the structural team. The project is LEED Platinum-certified, a status it could not have achieved without features like a thermally efficient building envelope, a 16-Kw photovoltaic array, office space largely illuminated by daylight, and carefully selected materials. However, the desire to make the water-management cycle experiential clearly provided the project's organizing theme. According to Joan Krevlin, partner at BKSK Architects, the project's New York City–based design firm, the building and the landscape are arranged around water, so that

"visitors are always crossing it, seeing it, and experiencing it."

Soils:

The USDA database shows Fargo soils are composed of very deep, poorly drained, and very-poorly drained, slowly permeable soils that formed in calcareous, clayey lacustrine sediments. These soils are on glacial lake plains, floodplains, and gently sloping side slopes of streams within glacial lake plains.

Slope:

Slopes within the city range from 0 to 6 percent.

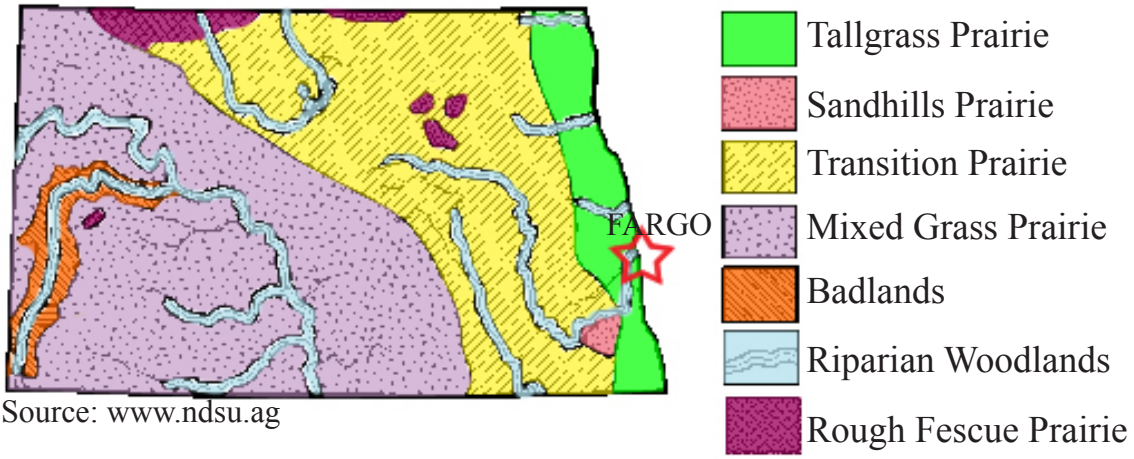
Temperature:

Fargo's mean annual air temperature is 42 degrees F.
USDA Plant Hardiness Zone 4
On average, the warmest month is July
The highest recorded temperature was 114°F in 1936
The average coolest month is January
The lowest recorded temperature was -48°F in 1887

Precipitation:

Mean annual precipitation is 19 inches.
The maximum average precipitation occurs in June

North Dakota vegetation distribution by land type:



Source: www.ndsu.ag

Geography:

Latitude: 46° 55’ 31” N (deg min sec),
Longitude: 96° 48’ 40” W (deg min sec),
Elevation: 274 metres (900 feet)

The old brick and stone buildings of Downtown Fargo retain much of the city’s past. Intersected by railroad tracks, this neighborhood of old Fargo reminds us how dependant the city once was to the railroads.

Broadway and 1st Ave. N Photo: Jodi Sagvold

Prevailing Winds, Fargo

	Mean Speed	Prevailing direction	Fastest Mile
January	13.2	SSE	62
February	13.0	N	56
March	13.6	N	56
April	14.9	N	68
May	13.8	N	72
June	12.2	SSE	115
July	10.9	S	60
August	11.4	SSE	71
September	12.5	SSE	88
October	13.1	SSE	57
November	13.7	S	66
December	12.8	S	58
Year	12.9	N	115
Yrs. of record	30		

www.npwrc.usgs.gov/resource/habitat/climate/wind

Re-creating threatened eco-systems within urban environments.

The threatened eco-systems of the Sheyenne National Grasslands are located 26 miles South-east of the growing city of Fargo, North Dakota. The core of this project is in developing awareness to the fragile ecosystems nearby and how fragmentation of these ecosystems results in the extinction of its' species.

"Of 1,200 plant species in North Dakota, 850 can be found on the Sheyenne Grasslands, such as the threatened western prairie white-fringed orchid and the beach heather."

www.ransomcountynd.com

Criteria for Site Selection:

The creation of a Fen system requires access to water, such as a river or lake, as well as the ability to drain stream water off site.

To maximize exposure to residents, the location should be within an urban setting with pedestrian access to many residential neighborhoods.

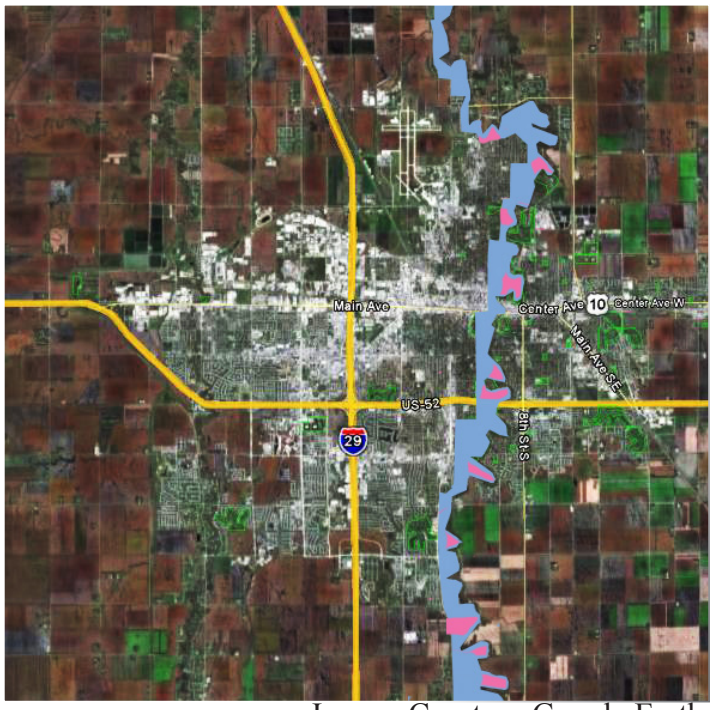
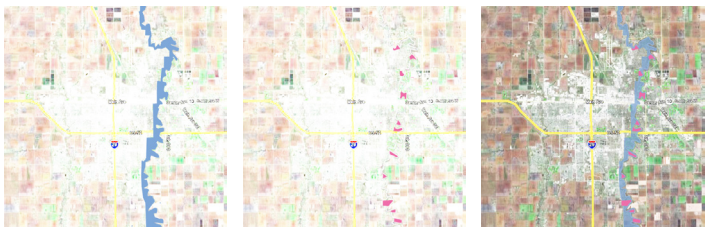


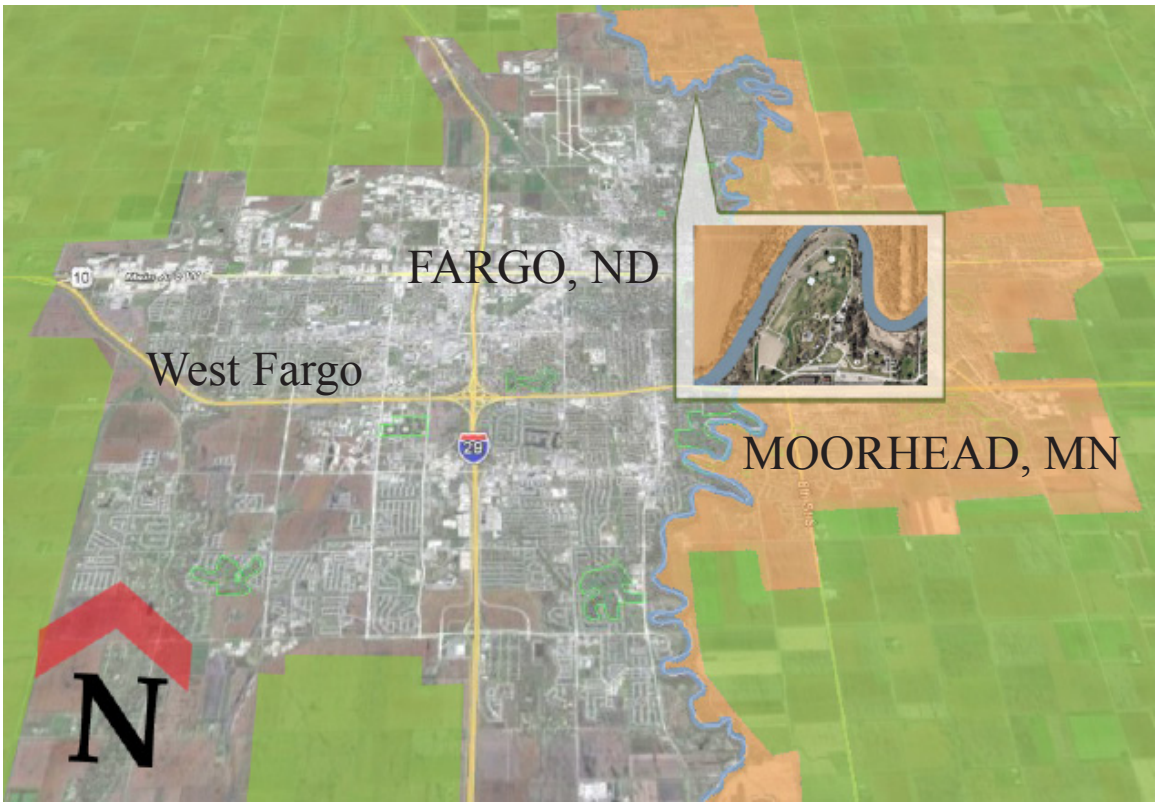
Image: Courtesy Google Earth

The Blue stripe running North/South represents the Red River of the North, which runs directly through the cities of Fargo, North Dakota; and Moorhead, Minnesota.

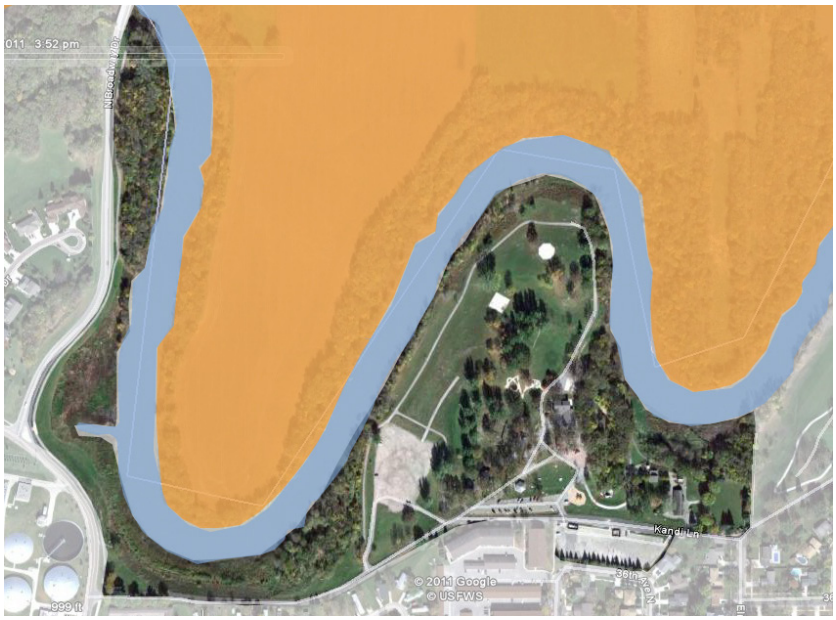
The 11 Pink spaces within the blue line represent possible site locations for a botanic garden with access to water for a Fen system.



Site Location Within the Fargo/Moorhead Metro Area:



The Site: The “Old Trollwood” Site
Population of Neighborhood: 2,701



Site Area (in green): Approximately 1,434,120 sq. ft.
or 1/4 mile x 1/4 mile

Recent research has established that healthy riparian corridors provide significant benefits to a watershed including:

* Filter and store sediment, nutrients, pesticides, and metals from upland surface and groundwater through infiltration, uptake, and transformation.

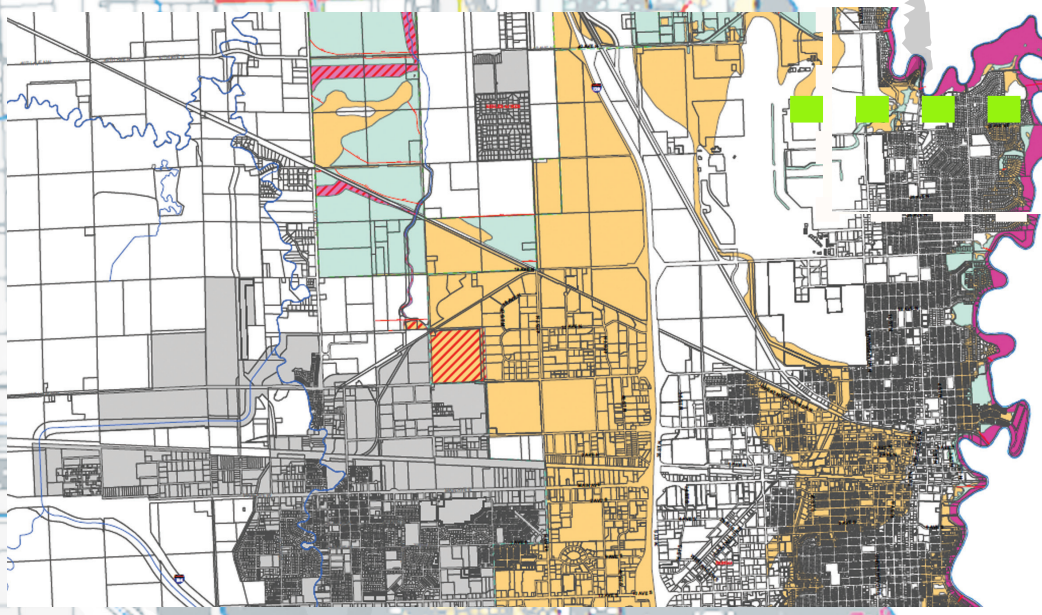
* Control the hydrodynamic interaction of the stream with the adjacent uplands, stabilizing stream banks, moderating flood discharges, and improving groundwater recharge.

* Support high biological diversity and productivity of vegetation, mammals, birds, and fish.

www.ndhealth.gov

Image of a natural riparian corridor, Sheyenne River, Sheyenne National Grasslands.
Photo by Jodi Sagvold

FEMA Floodplain Map for Fargo, N.D.



FARGO

Much of the Trollwood site lies within the FEMA Floodplain Floodway, shown in magenta.

Recurring flooding was cited as the primary reason the Trollwood Performing Arts Center was relocated. The site is currently in a trasition mode as other structural elements such as this large stage-backdrop (right), lighting and support system, seen here in October 2010, have already been removed or relocated.

Analysis:
Fargo Floodwall Protection

Image courtesy Fargo Forum

Above: “Spirit of Fargo” sand baskets are used for flood protection at Trollwood Park, Spring 2011

Below: Steps equipped with a flood-gate near the Main Ave. bridge, Spring 2011

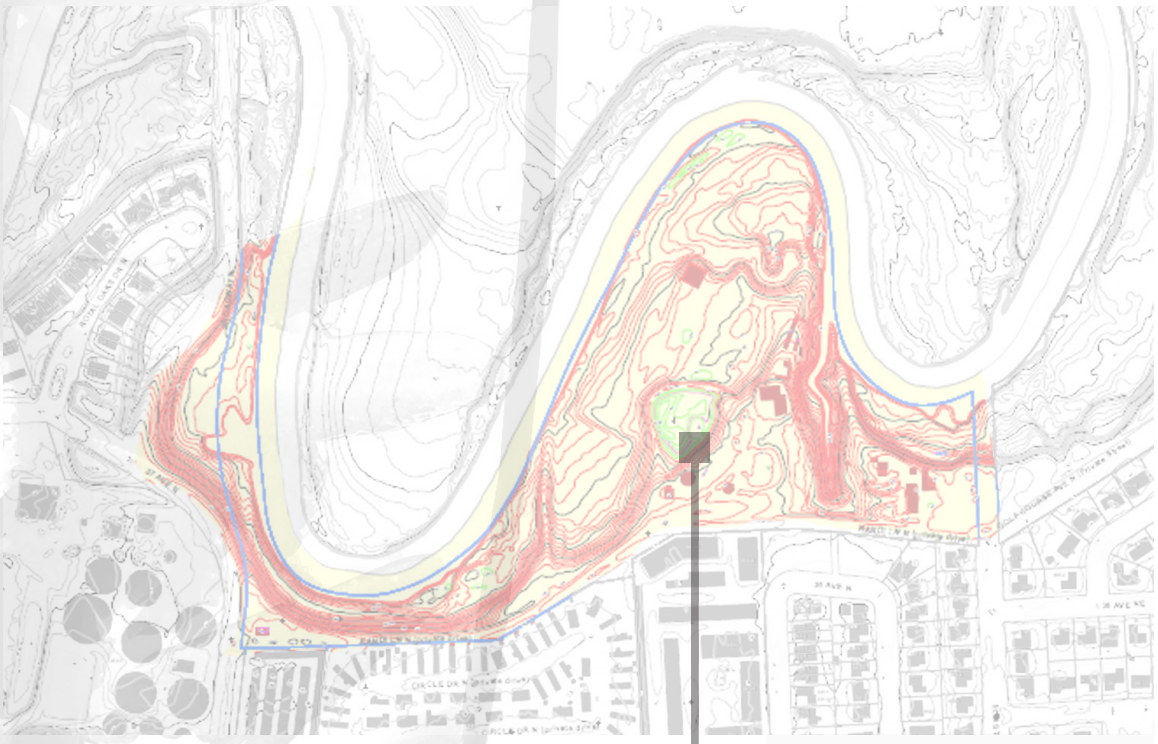
Above: Removable flood-walls used by the cities of Fargo and Moorhead for the first time this spring held up well during the flood, engineering officials say*, Spring 2011
*secure.forumcomm.com

Below: 2 images of the premier location to view the rising flood waters, the Fargo -Moorhead main ave. bridge. Note the lack of vehicular/ pedestrian separation.

The North Dakota Unified Water Assessment for 1999 listed 3000 miles of rivers and streams as partially supporting aquatic life and anther 7400 miles as fully supporting, but threatened. Fifty percent of the watersheds within the North Dakota portion of the Red River Basin are categorized as needing restoration. The major stressor for these affected basins is listed as agriculture including impacts from nutrient and sediment runoff.

www.ndhealth.gov

Healthy riparian corridors provide significant benefits to a watershed. These vegetated zones filter and store sediment, nutrients, pesticides, and metals through the processes of infiltration, filtering, uptake, and transformation.



Site Analysis

Site Analysis Narrative

Image of a Fen system in North Dakota's Sheyenne National Grassland Jodi Sagvold

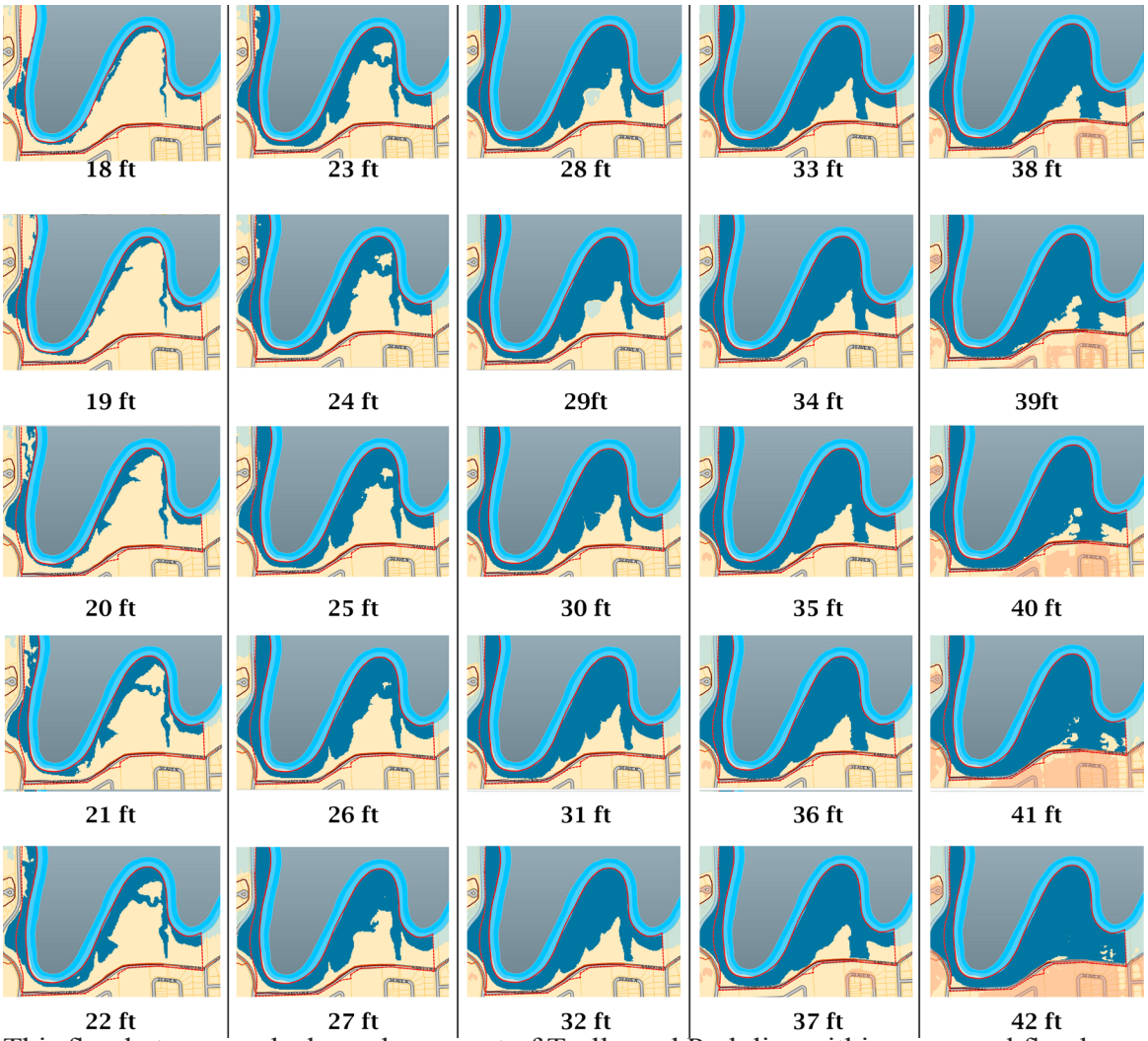
Image of a threatened Western Fringed Prairie Orchid www.extension.iastate.edu

While searching for local and regional ecosystems which contain threatened species, North Dakota's Fen systems, or ground-water fed streams were at the top of most lists. Many threatened species can be found where tall-grass prairies meet wetland systems, and in the case of the Sheyenne National Grasslands, these wetlands are primarily fens. By re-creating this rare ecosystem within an urban environment, threatened species protected by federal and state laws will have new habitat within a growing city.

With special attention to ecosystem connections, insects and other pollinators and benefitial organisms can also use these sites.

These wet grasslands are home to threatened plants such as the Western Fringed Prairie Orchid.

The official flood stage of the Red River at Fargo is 18'
2009's record setting crest was 40.84'

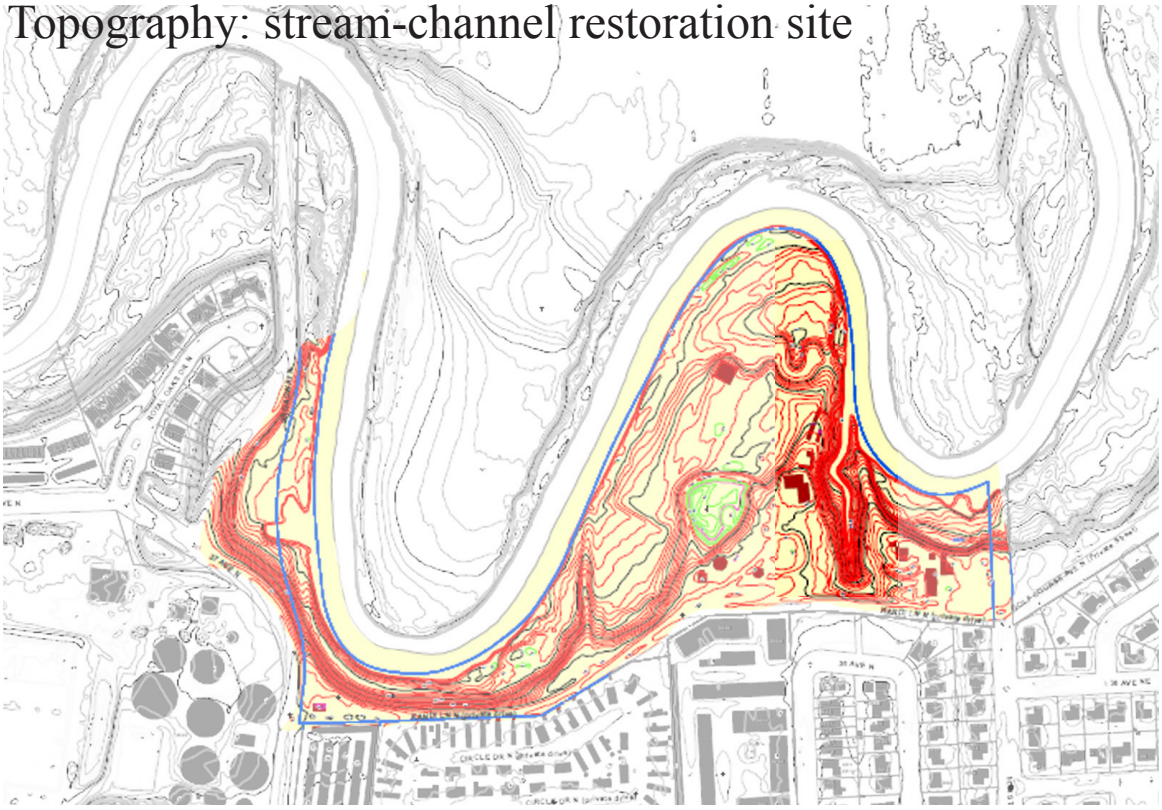


This flood-stage graph shows how most of Trollwood Park lies within an annual flood plain.

SITE ANALYSIS

This site was chosen in part for this stream-channel. Though filled with concrete in the past, great potential exists for a storm water purification area in the streambed on site.

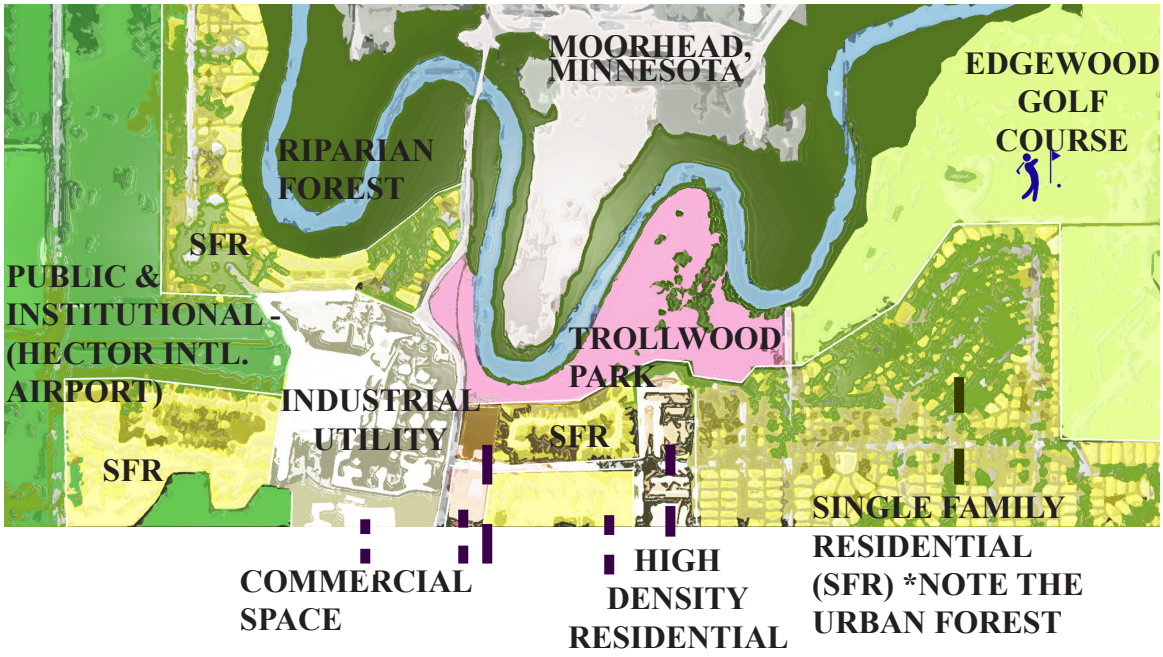
Topography: stream-channel restoration site



Winter shots reveal open water, even in late February, making this stream-channel prime wildlife Habitat for Winter water use.

Photos: by Jodi Sagvold

Land Use Map - TROLLWOOD PARK NEIGHBORHOOD, FARGO, N.D.



This particular site was chosen not only because of its relation to the Red River, but also its Urban Wildlife Interface, or mature urban forest and associated wildlife corridors running throughout the Trollwood neighborhood. The Trollwood Site is a major greenspace connection between other large Public and Institutional Greenspaces. Even the Single Family Residential (SFR) neighborhoods contain an urban forest of mature Elm, Linden, Common Hackberry, Spruce, Ash, and ornamental trees, which form one continuous urban wildlife corridor within their canopy.

Fargo's Urban Wildlife include:

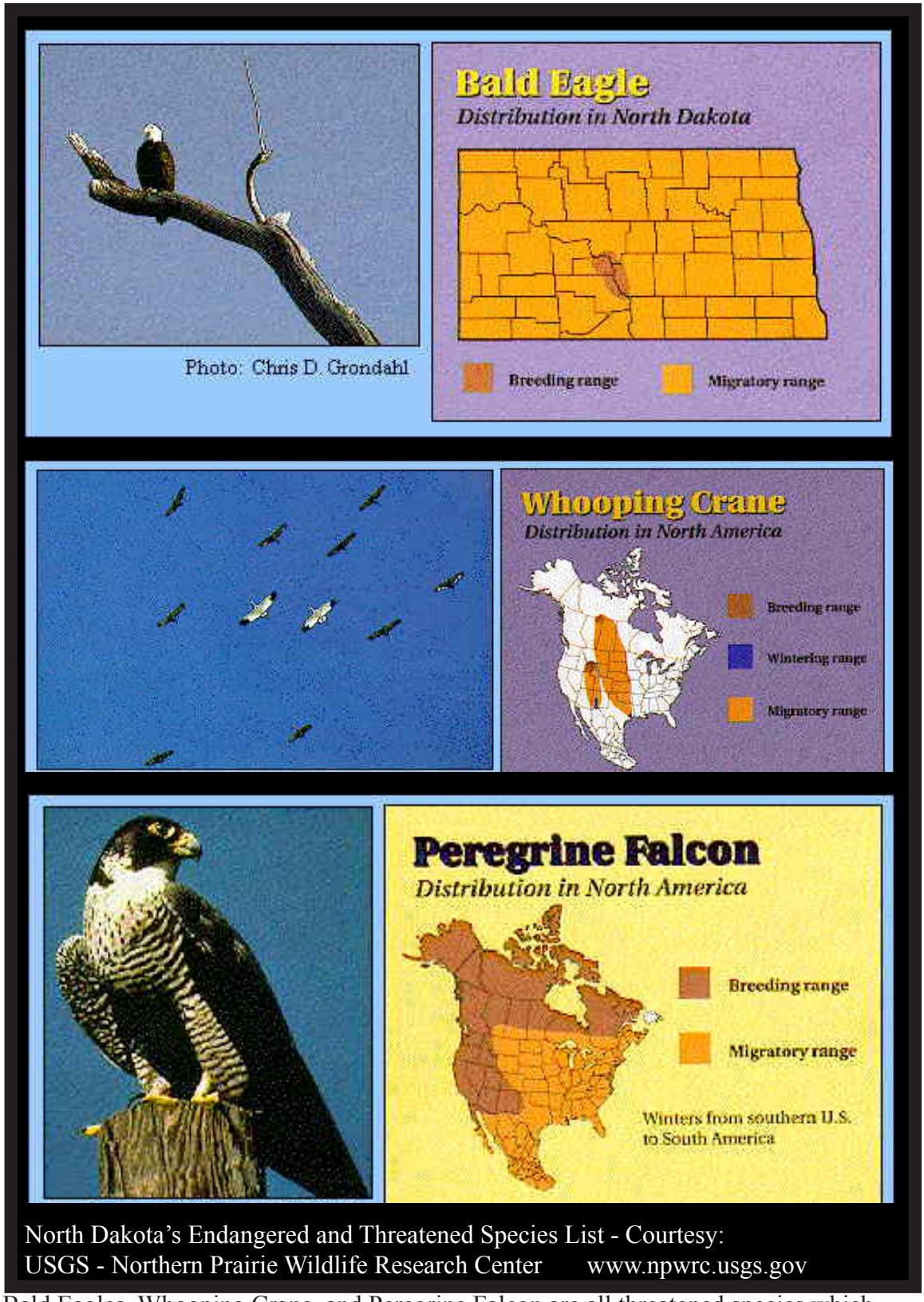
- Rabbits
- Squirrels
- Raccoon
- Birds
- Bats
- Snakes
- Chipmunk
- Fox
- Coyote
- Deer
- and many insects such as Butterfly, Dragonfly, and Bee species, among others

A resident near the Fargo Country Club captured this recent image of a coyote that killed a deer on the fairway near the fourth hole. 02/11/2011 Though not an everyday occurrence, North Dakota's harsh Winters cause shy wildlife like this coyote to stray closer to metropolitan areas in search of food. Most of Fargo's rural residents would agree that Coyotes, while a possible threat to young calves and small livestock, dogs, and cats, are timid creatures which can be easily scared away by Humans. The scent of Humans in the Trollwood neighborhood will act as a natural repellant, preventing Coyotes from using the Trollwood site.


Image: Fishingbuddy.com

While Coyotes are not considered endangered, all sightings of wildlife can be an adventure. A look at North Dakota's Endangered and Threatened Species List reveals many of the Mammals, Birds, and Fish on the list have a migratory range which extends far from their breeding grounds, some extending through Fargo. Final selection for the proposed habitat restoration site(s) should be based upon:

- Vicinity to migratory routes and/or permanent residence
- Endangerment or threat levels for each specie of concern
- Proximity to a high-density urban population should also be considered. Larger communities correspond to higher patronage opportunity. More patrons equate to more educational opportunities.



Bald Eagles, Whooping Crane, and Peregrine Falcon are all threatened species which migrate through the Red River Valley. Mature trees and habitat near water create a draw for these protected species of Bird.

When Congress authorized the Endangered Species Act, they declared that species of "fish, wildlife, and plants are of aesthetic, ecological, historical, recreational and scientific value to the Nation and its people."

The intent of this law was not simply to develop a list of species in danger of extinction, but to develop plans that would recover populations of these species to a point where they could be removed from the list.

www.npwrc.usgs.gov

Spiranthes magnicamporum
Great Plains ladies'-tresses Orchid

Photo by Jodi Sagvold

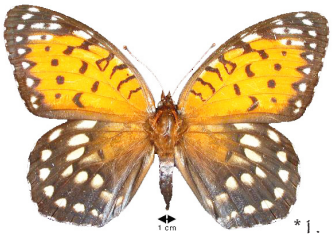
This proposal will look into providing North Dakota's Federally Listed Endangered, Threatened, and Candidate Species with new, urban ecosystems for the purpose of:

1.) Reversing the loss of rare, regional habitats through changes in land use

2.) Increasing the numbers of Imperiled plant species through seed collection and propogation methods

3.) Providing educational opportunities about the goals and relevance of this project

Candidates for Habitat Restoration, Fargo, ND



*1. Speyeria idalia
Regal Fritillary Butterfly

*2. Hesperia dacotae male
Dakota Skipper Butterfly

Two of North Dakota's native Butterfly species are facing loss of habitat as tallgrass prairies and oak savannahs are converted to other uses such as agriculture and urban expansion.

Both of these butterflies depend upon particular native plant species for their survival. The chosen site must offer opportunities to provide habitat for both while acting as a seed bank for the native grasses and violets which are necessary for their survival.

---

*1. Speyeria idalia
Regal Fritillary Butterfly
(Image courtesy www.gpnc.org)

Regal Fritillary: Present Status: Remains a species of management concern. The regal fritillary is extirpated (no longer exists) in Canada, most of New England, and the Ohio Valley. It is presently found only in scattered populations. It seems to be rapidly declining in the prairie states. It is now restricted in North Dakota to the southeastern and south-central counties. It is commonly found in the Sheyenne National Grasslands in southeastern North Dakota.

Habitat:
The regal fritillary is always associated with open grass-like areas. Tall grass prairie is typical habitat in the western part of its range with bluestem grass being an indicator of the proper habitat. In the east part of its range the regal fritillary is found in damp meadows and marshy areas.

Life History:
The butterflies emerge from their over winter larval (caterpillar) state in late June to early July, with the males emerging a week before the females. Milkweed, thistles, and clover are used by the adults as nectar sources. The males patrol areas throughout the day looking for receptive females. They are especially active in late morning and early afternoon. After mating, the females diapause (rest) until late summer, when the eggs are laid singly on a variety of plants. The larvae feed during the night and are obligate violet feeders (they feed only on the leaves of violets). During the day the larvae move away from the violet plant and hide.*

*www.npwrc.usgs.gov

Wild Violet Photo: Jodi Sagvold

*2. Hesperia dacotae male
Dakota Skipper Butterfly
(Image courtesy www.gpnc.org)

Dakota Skipper: Present Status: Remains a species of management concern. The Dakota skipper is now extirpated (no longer exists) in Illinois and Iowa. The last remaining stronghold of the Dakota skipper in the United States appears to be in western Minnesota, northeastern South Dakota and most of North Dakota. Within this area the Dakota skipper has been reduced to scattered, fragmented populations where undisturbed native prairie remains. Evidence suggests that North Dakota has the largest, and most stable population of Dakota skippers in the world.*

*www.npwrc.usgs.gov

Historical Status:
The original range of the Dakota skipper appears to have been from southern Manitoba, across the Dakotas and Minnesota to Iowa and Illinois.

Habitat:
The Dakota skipper can survive only in undisturbed tall grass and mid-grass prairie. In the western part of its range the Dakota skipper can be found in ungrazed native pastures with little bluestem, needle and thread, and purple coneflower. In the eastern pert of its range it is found in bluestem grass prairies, usually with the forb camas.

Life History:
The Dakota skipper changes from its larva (caterpillar) state to its butterfly state in mid-June. Both sexes emerge about the same time. Male butterflies perch on plants and wait for females to come by. After mating, females lay eggs on all types of plants from mid-June through early July. One generation is produced annually. The adults die by late July. The eggs hatch in 7 to 10 days. After hatching, the pale-brown larvae build tunnel-like silken nests near the ground from which they emerge at night to feed. Bluestem grass is a favorite foodplant of the larval stage. The larvae go through six larval stages, the fourth (possibly fifth) of which overwinters in a nest it builds with duff and silk. Dakota skipper butterflies rarely travel more than 1/2 mile in their lifetime. Adult butterflies feed on nectar from coneflowers and other native prairie wildflowers.*

*www.npwrc.usgs.gov

North Dakota's native Orchids.

All 14 of North Dakota's native Orchids are to be considered for this habitat restoration project as the ecosystems they inhabit are also home to many of North Dakota's other Imperiled species such as: Dune Ragwort, Bicknell's Sunrose, Upright Pinweed, Northern Lady-fern, and the Adder Fern.

Platanthera praeclara - Western Prairie Fringed Orchid A "Showpiece of the Great Plains"

Wild Orchids of the Prairies and Great Plains Region of North America

The Western Prairie Finged Orchid is Federally listed as threatened and has had perhaps more efforts directed toward its status and recovery than any other orchid in North America.*

(*CPC Plant Profile 9293)

1. Western Prairie Fringed Orchis - Platanthera praeclara
   Habitat: wet prairies, fens, open plains
   Federally listed as threatened, very rare and local

Image, Western Prairie Fringed Orchid, courtesy: www.naturenorth.com

2. Long-Bracted Green Orchis - Coeloglossum viride var. virescens
   Habitat: deciduous woodlands, open coniferous forests, and road-sides

3. Western Spotted Coralroot - Corallorhiza maculata
   Habitat: rich mesic and mixed forests

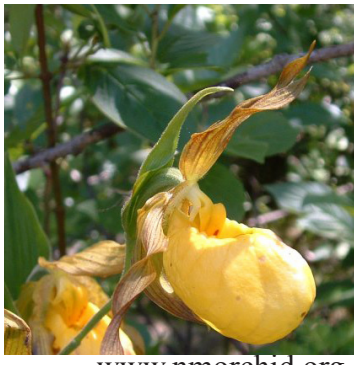
4. Striped Coralroot - Corallorhiza striata var. striata
   Habitat: rich mesic and mixed forests

5. Early Coralroot - Corallorhiza trifida
   Habitat: rich mesic and mixed forests, open tundra and barrens

6. Small White Lady's-Slipper - Cypripedium candidum
   Habitat: calcareous prairies and fens

7. Northern Small Yellow Lady's-Slipper - Cypripedium parviflorum var. makasin
   Habitat: mesic to calcareous, moist woodlands, streamsides, bogs, and fens

8. Large Yellow Lady's-Slipper - Cypripedium parviflorum var. pubescens
   Habitat: a wide variety of mesic to calcareous, wet to dry woodlands, streamsides, bogs, fens



www.nmorchid.org

9. Showy Lady's-Slipper - Cypripedium reginae
   Habitat: wet swamps, seeps, calcareous meadows, and open woodlands


www.dnr.state.mn.us

10. Giant Rattlesnake Orchis - Goodyera oblongifolia
    Habitat: dry, mixed and deciduous woodlands

11. Northern Green Bog Orchis - Platanthera aquilonis
    Habitat: open wet meadows, roadside ditches and seeps, fens, bogs and river gravels

12. Rose Pogonia - Pogonia ophioglossoides
    Habitat: moist meadows, open bogs and prairies, roadside ditches, and sphagnous seeps

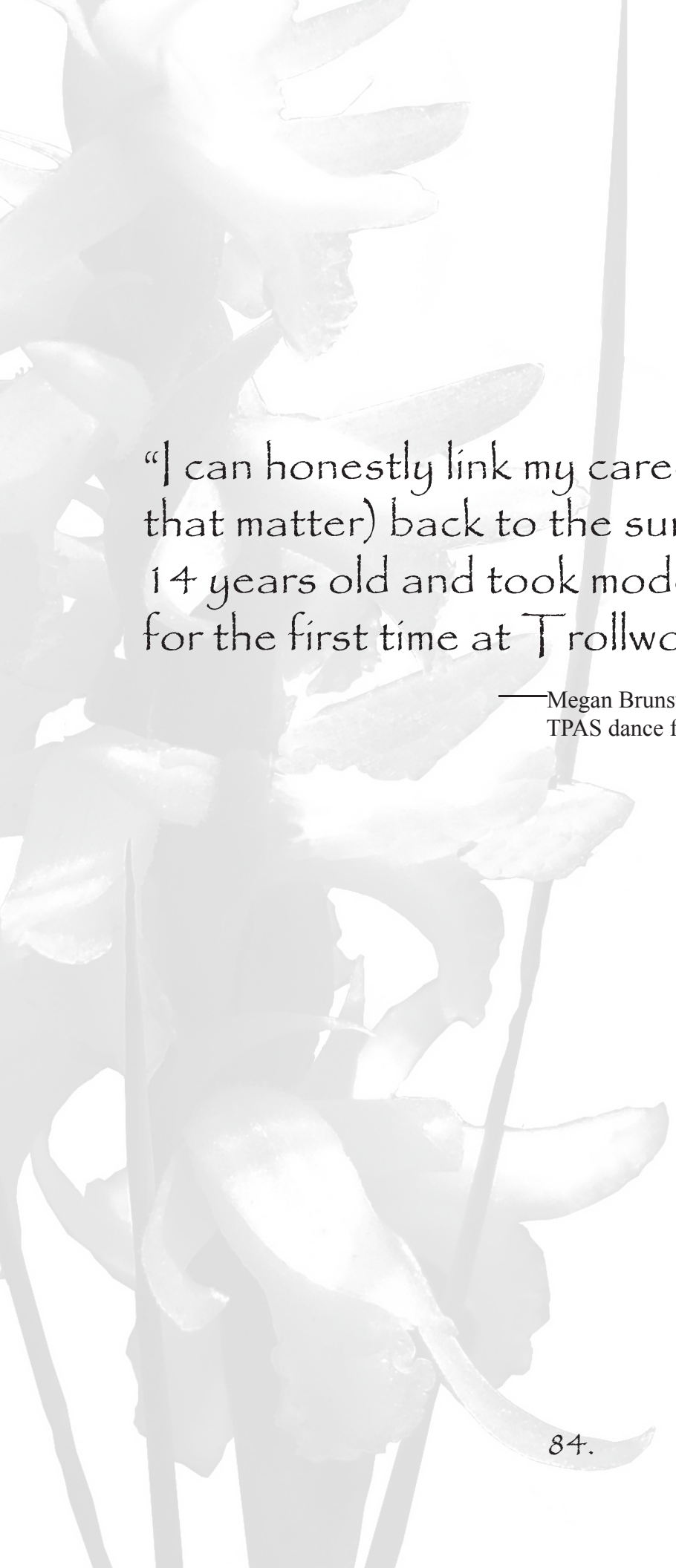
13. Great Plains Ladies'-Tresses - Spiranthes magnicamporum
    Habitat: wet to dry alkaline prairies, bluffs, and fens

14. Hooded Ladies'-Tresses - Spiranthes romanzoffiana
    Habitat: rocky riverbanks, seeps, fens; usually calcareous

Site Photos: by Jodi Sagvold

The Reineke Foundation Presented the Trollwood Performing Arts Program a grant for $65,830.00 June, 1990. This grant provided all the technical components to make the Trollwood Performing Arts Program and its staging area one of the best in the United States.

Reineke Foundation Trustees:



"I can honestly link my career (and life, for that matter) back to the summer I turned 14 years old and took modern dance class for the first time at Trollwood."

——Megan Brunsvold, TPAS alumna and former TPAS dance faculty www.trollwood.org

The Forum
of Fargo-Moorhead
Final edition Thursday, April 21, 2011 102,000 readers every day

Trollwood building to be razed

Unused structure prone to flooding

By Wendy Reuer
wreuer@forumcomm.com

FARGO – The Fargo Park District plans to raze a flood-prone building that is no longer used in Trollwood Park.

The dark red building once served as office space for Trollwood Performing Arts. The ground level housed a concession area and restrooms while the second level housed offices and storage, said Roger Gress, district executive director.

In 2009, the Trollwood Performing Arts School relocated to a new facility in south Moorhead after years of being flooded out at the Fargo location.

The building in question is no longer used and has been prone to vandalism and flood damage for many years, Gress said.

"It sits at flood stage 39 (feet), which is a real precarious level," he said. "We're suspecting there is a little bit of a mildew issue there, too. It's been flooded many times."

Gress said it is not economical for the district to keep up maintenance costs anymore.

TROLLWOOD: Page A5

David Samson / The Forum

This building in north Fargo's Trollwood Park is threatened by the Red River each spring and will be razed.

"Police and fire departments will also be allowed to use the building for training purposes before it is removed."

"...perhaps a boulder will be placed in that area of the park, to commemorate the building."

TROLLWOOD:

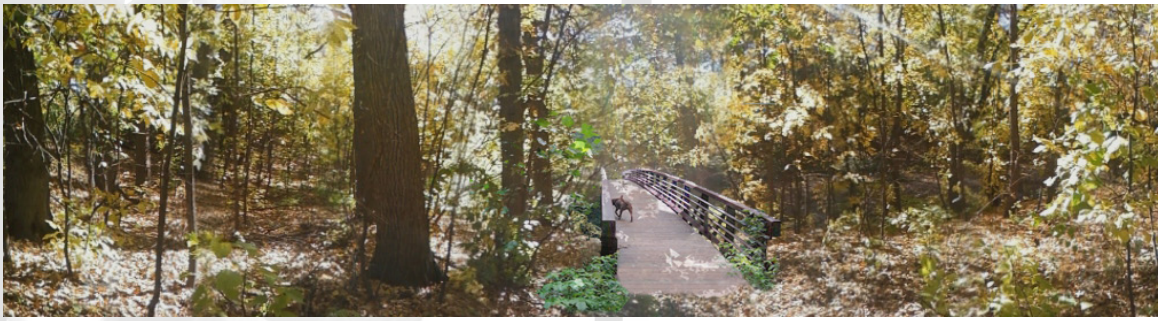
From Page A1

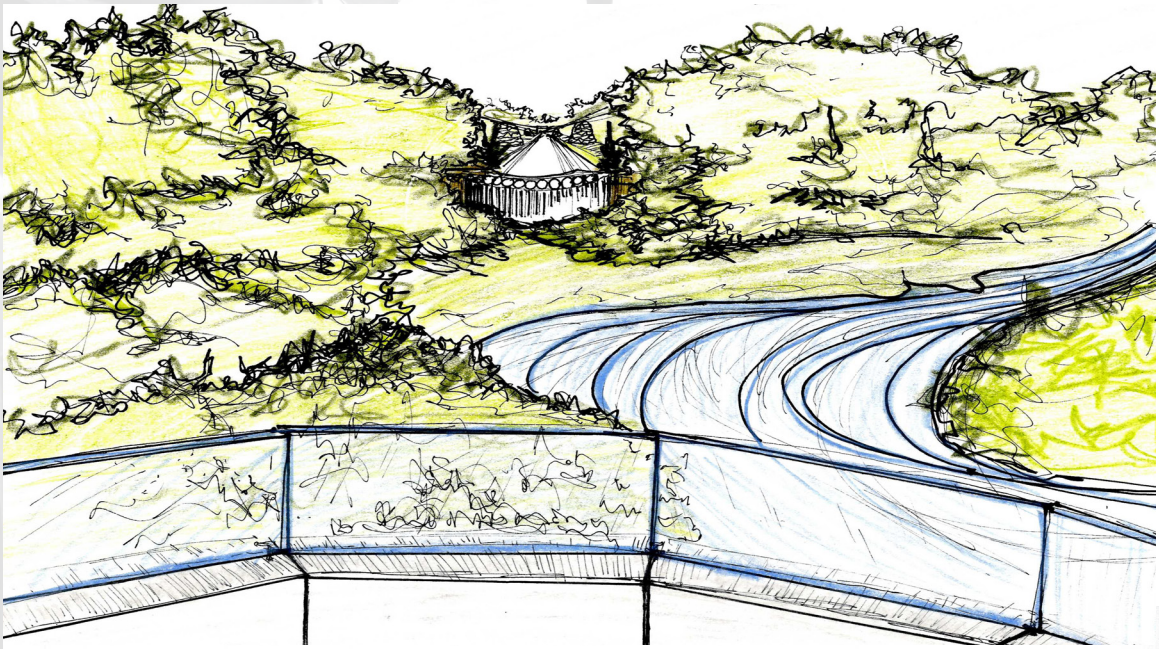
He said he is considering proposing some sort of memorial to the building; perhaps a boulder will be placed in that area of the park, to commemorate the building. Police and fire departments will also be allowed to use the building for training purposes before it is removed.

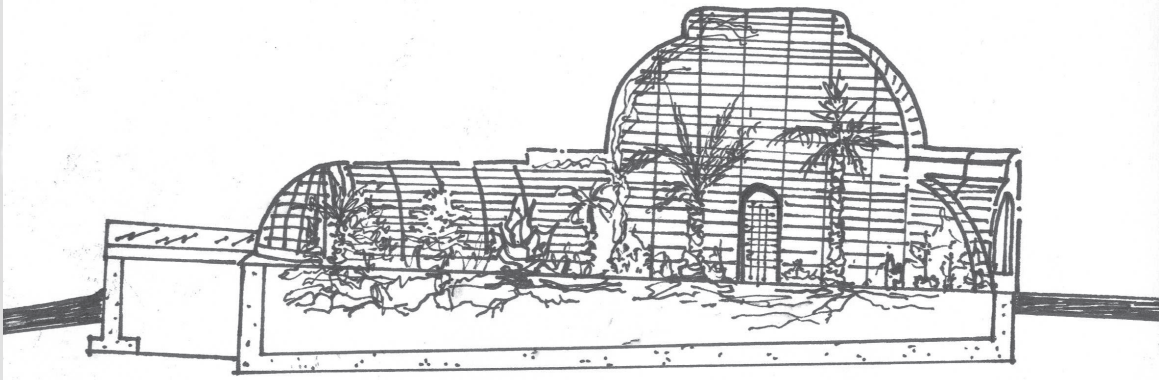
The district, during a meeting last week, approved the building's destruction.

The Vision ~Programatic Requirements

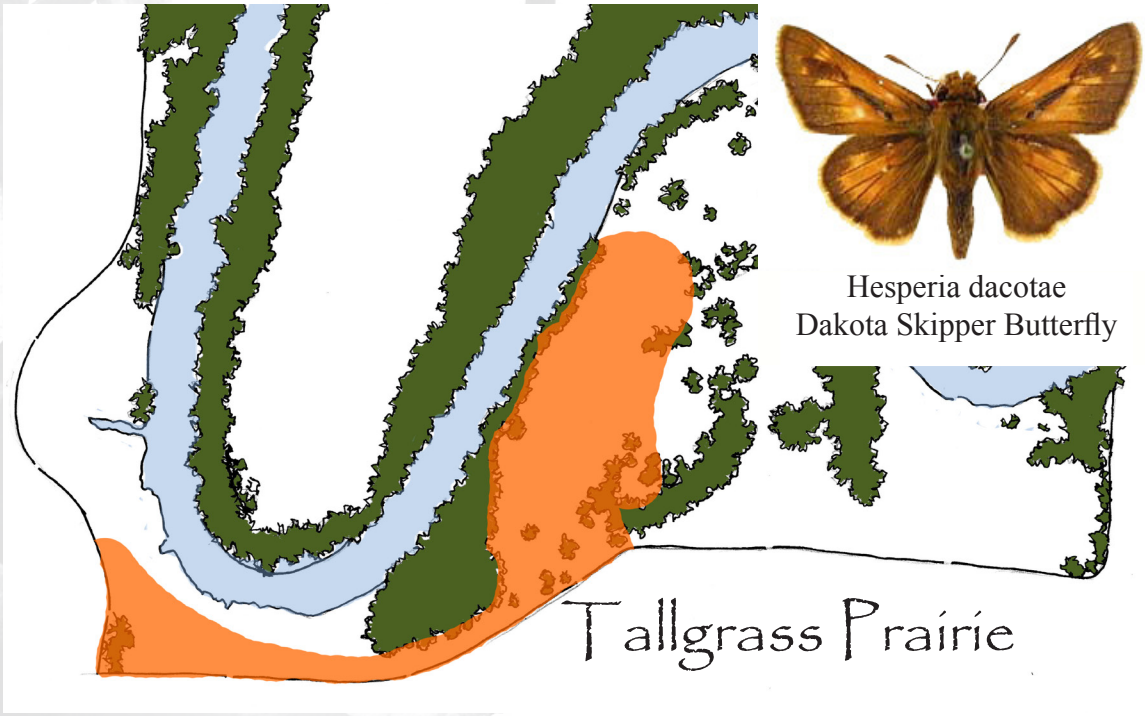
Wood, Water, Meadow ... Conservatory







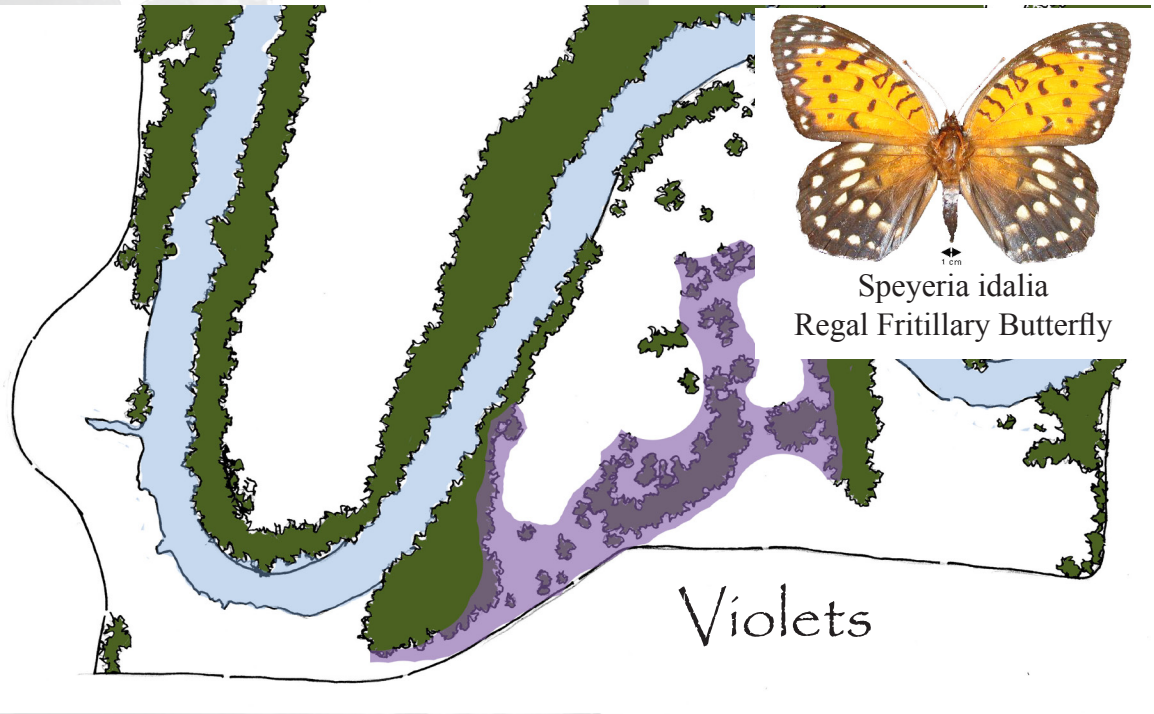
Habitat



Hesperia dacotae
Dakota Skipper Butterfly

North Dakota's native Dakota Skipper butterfly now has sufficient information to list as threatened or endangered. Dakota skippers are found in high quality native prairie containing a high diversity of wildflowers and grasses including bluestem grasses, needlegrass, pale purple and upright coneflowers, and blanketflower.

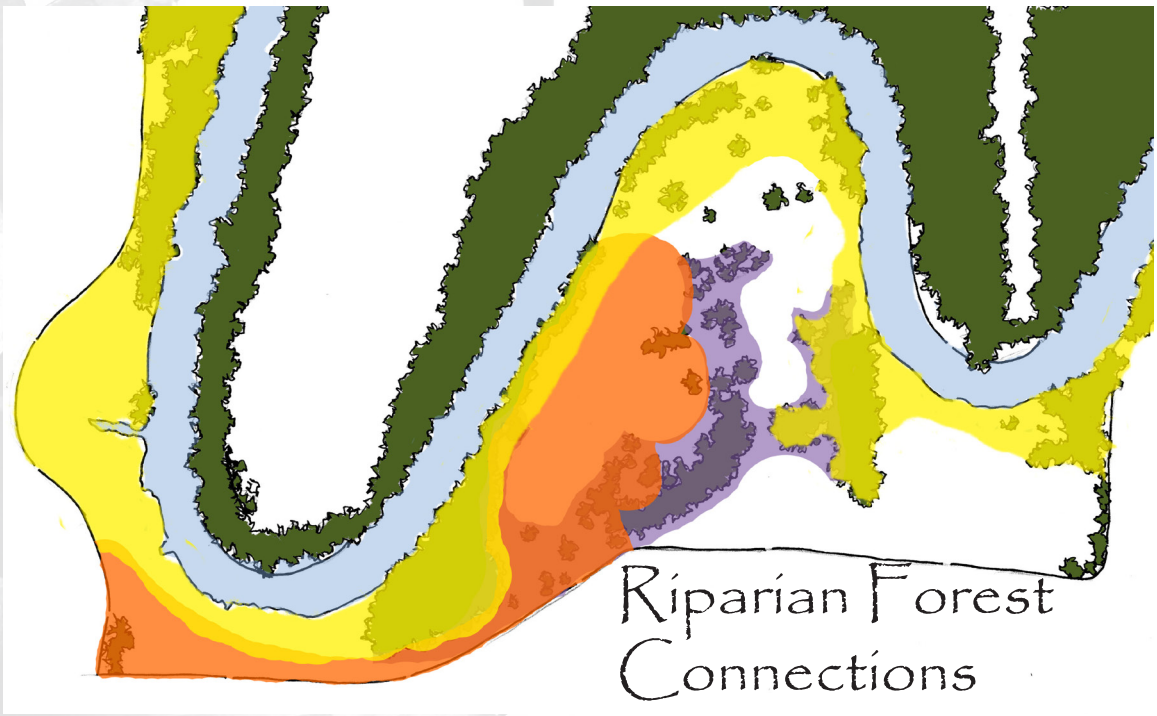
Habitat



Speyeria idalia
Regal Fritillary Butterfly

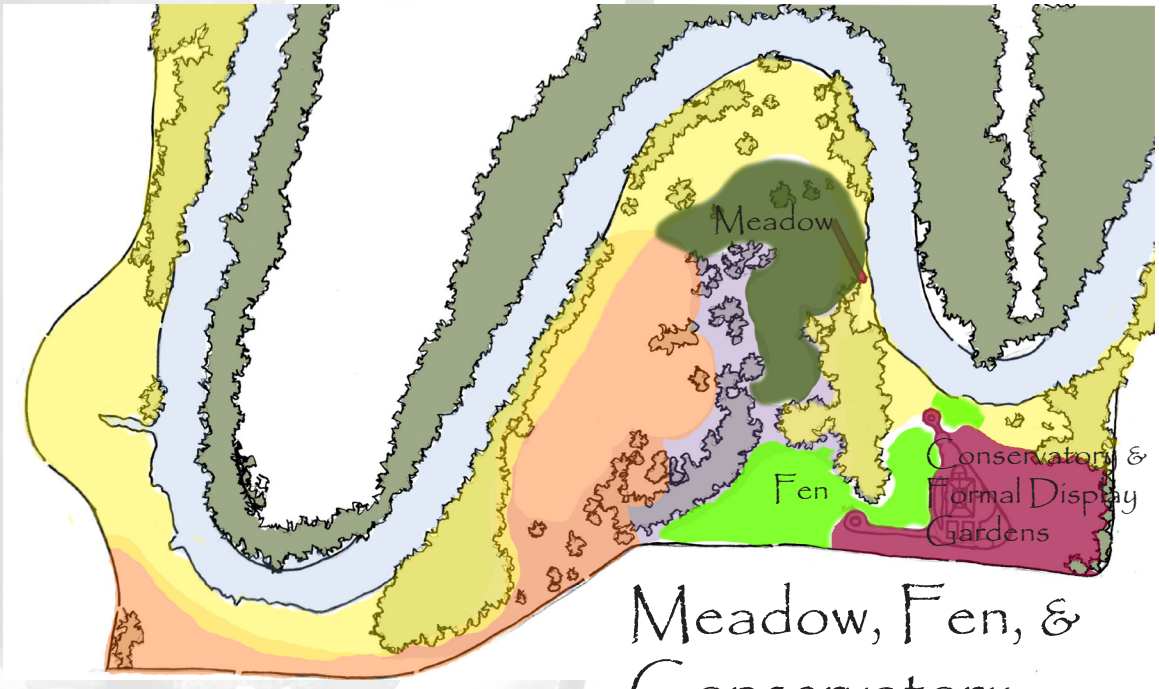
The caterpillars of Regal Fritillaries, eat only violets. In particular, Regals prefer the Birdsfoot Violet (Viola pedata) and Prairie Violet (Viola pedatifida). Summer shade provided by the canopy of the existing Bur Oak groves provides a choice environment for shade-loving violets, which naturalize easily in North Dakota's climate.

Wildlife Corridor Restoration



Healthy riparian corridors provide significant benefits to a watershed. These vegetated zones filter and store sediment, nutrients, pesticides, and metals through the processes of infiltration, filtering, uptake, and transformation.

Recreation & Plant Preservation



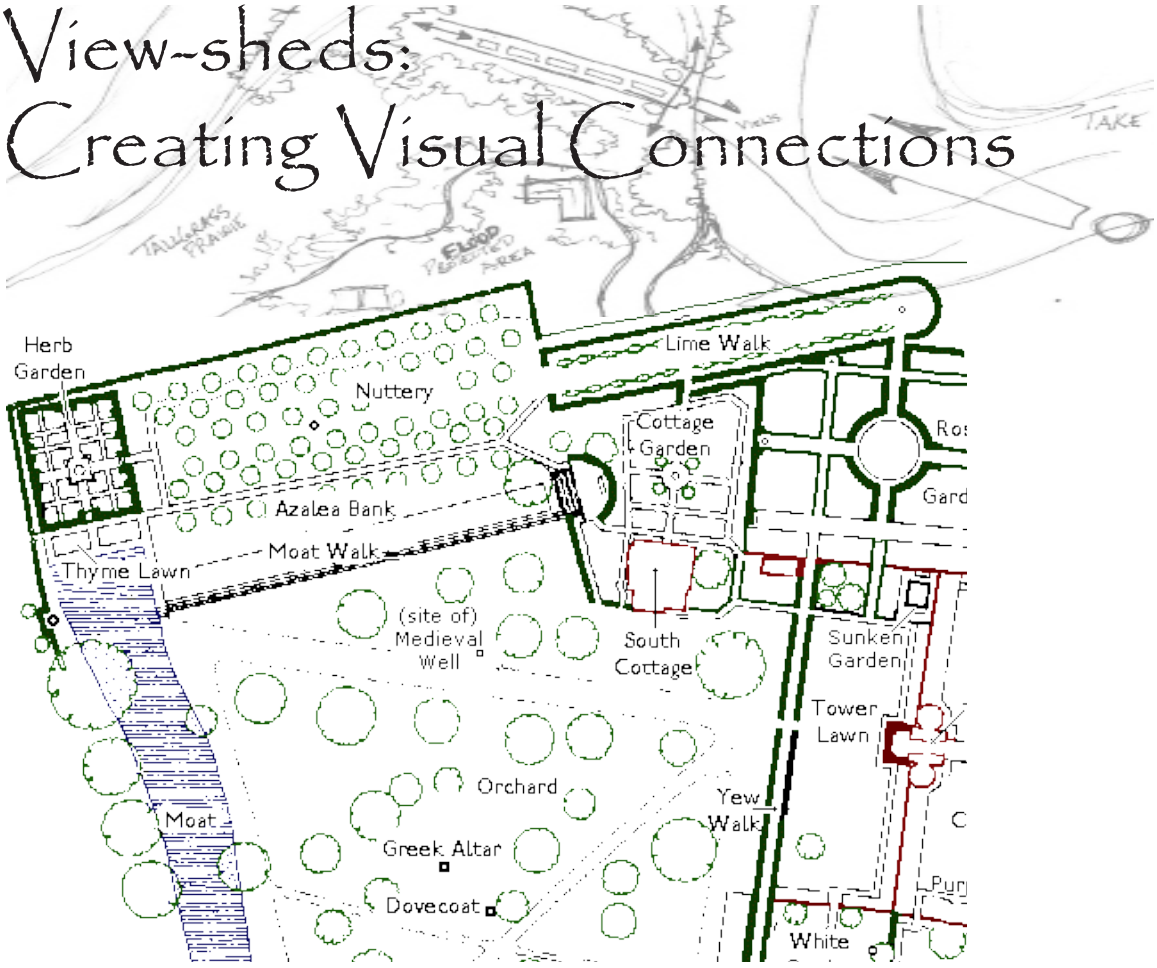
Meadow, Fen, & Conservatory

Meadow: The meadow is designed to be used for sunbathing on the lawn, and contains both native and ornamental plants. A rentable venue overlooks the rolling hills and retention pond.

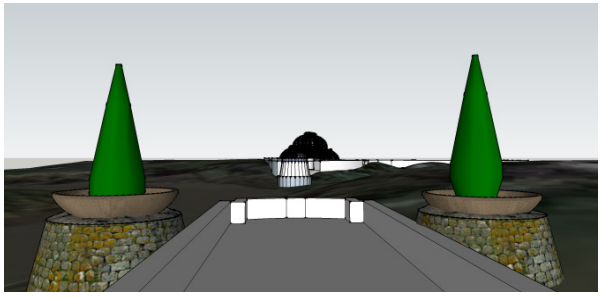
Fen: The fen begins at the Northern end of the conservatory and wraps around the building to the East. Water, pumped from the Red River, makes its way through three separate wetland systems before making its way to the woodland stream, and back into the river.

Conservatory and Formal Display Gardens: This area of the Botanical Garden houses most of the non-native species in indoor and outdoor settings.

View-sheds:
Creating Visual Connections



Taking inspiration from Britian's Royal Trust Gardens including Sissinghurst (above), view sheds and visual connections play an important role in the Trollwood Botanical Garden design.



The images to the right were created as a 3D model in Sketchup for the purpose of visual alignment and configuration to create the best possible view sheds.

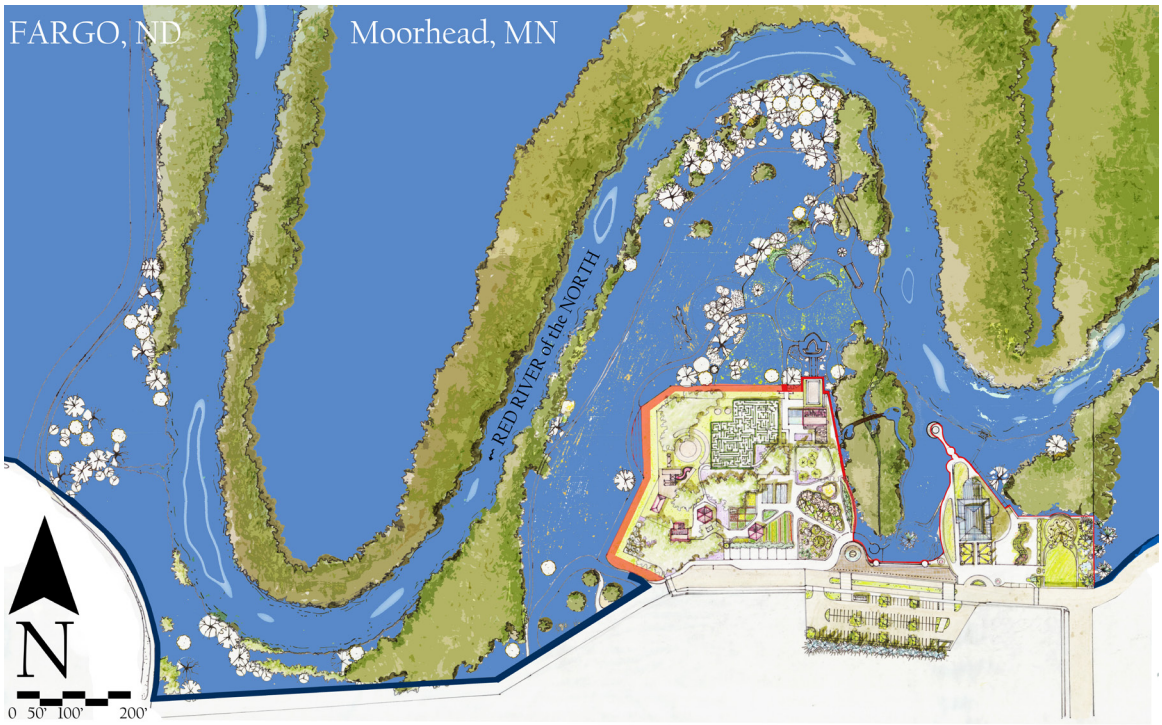
Final Design

Project Details & Presentation Boards

MASTER PLAN

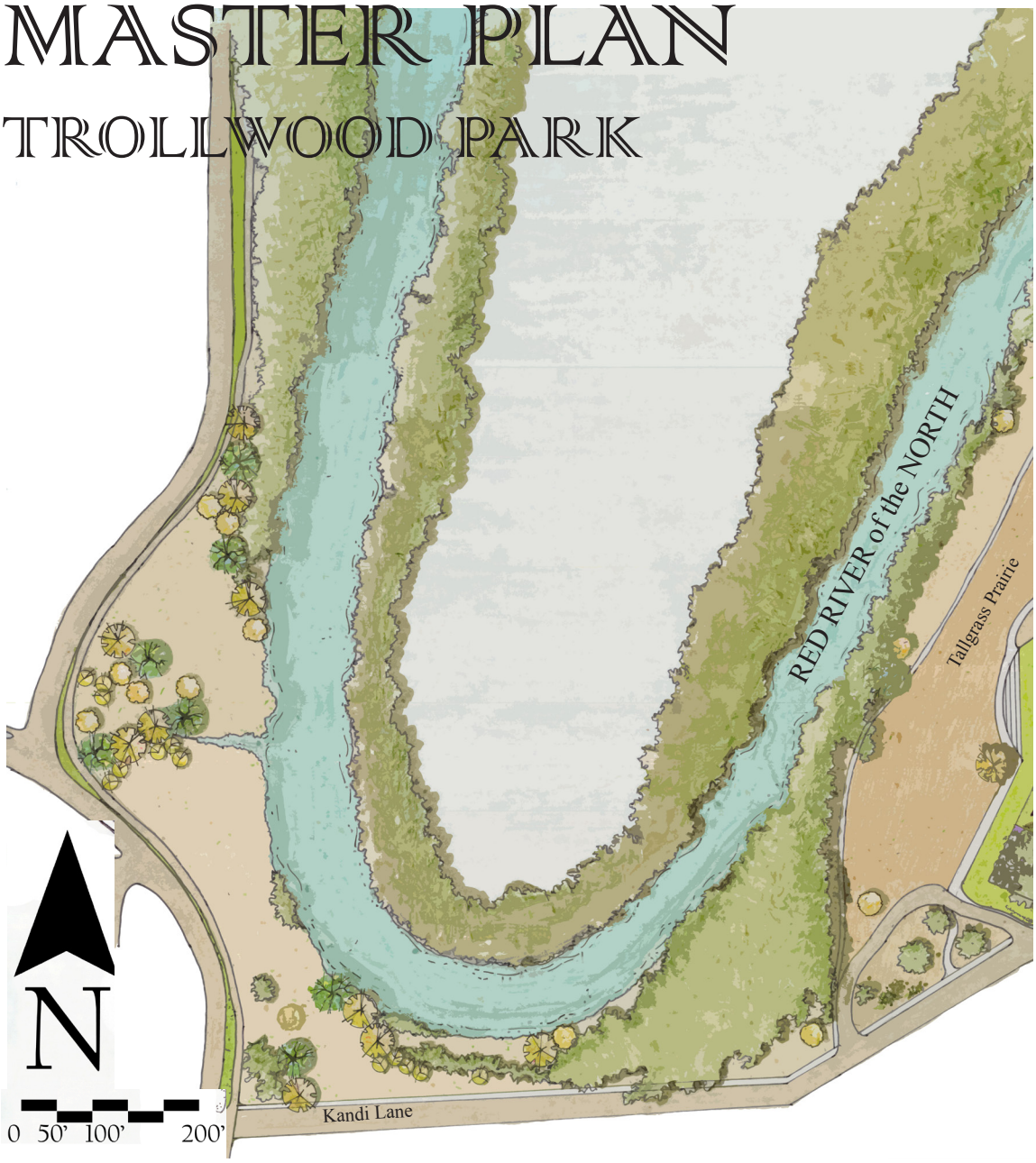
TROLLWOOD PARK

Trollwood Park during Spring flooding

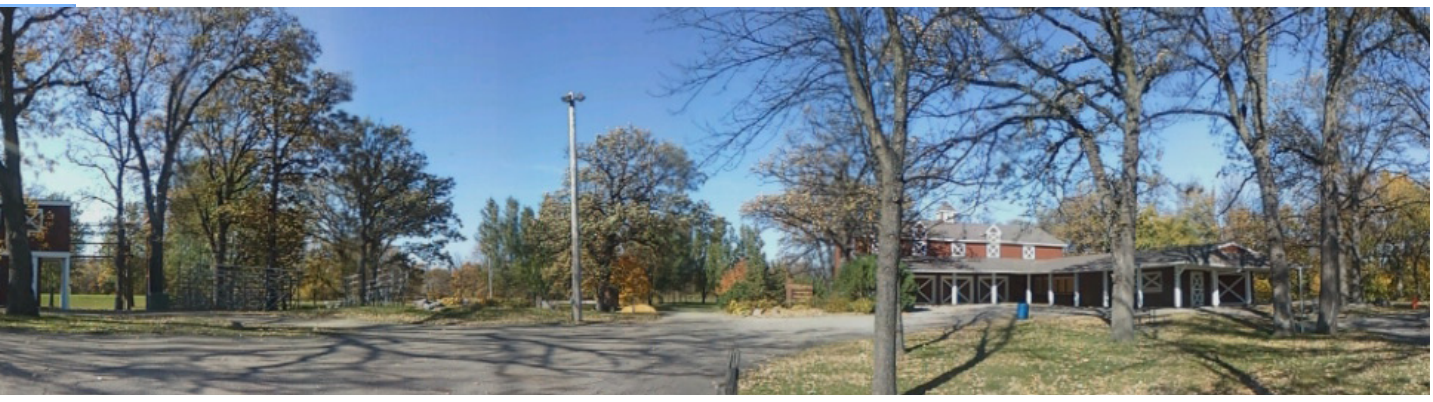


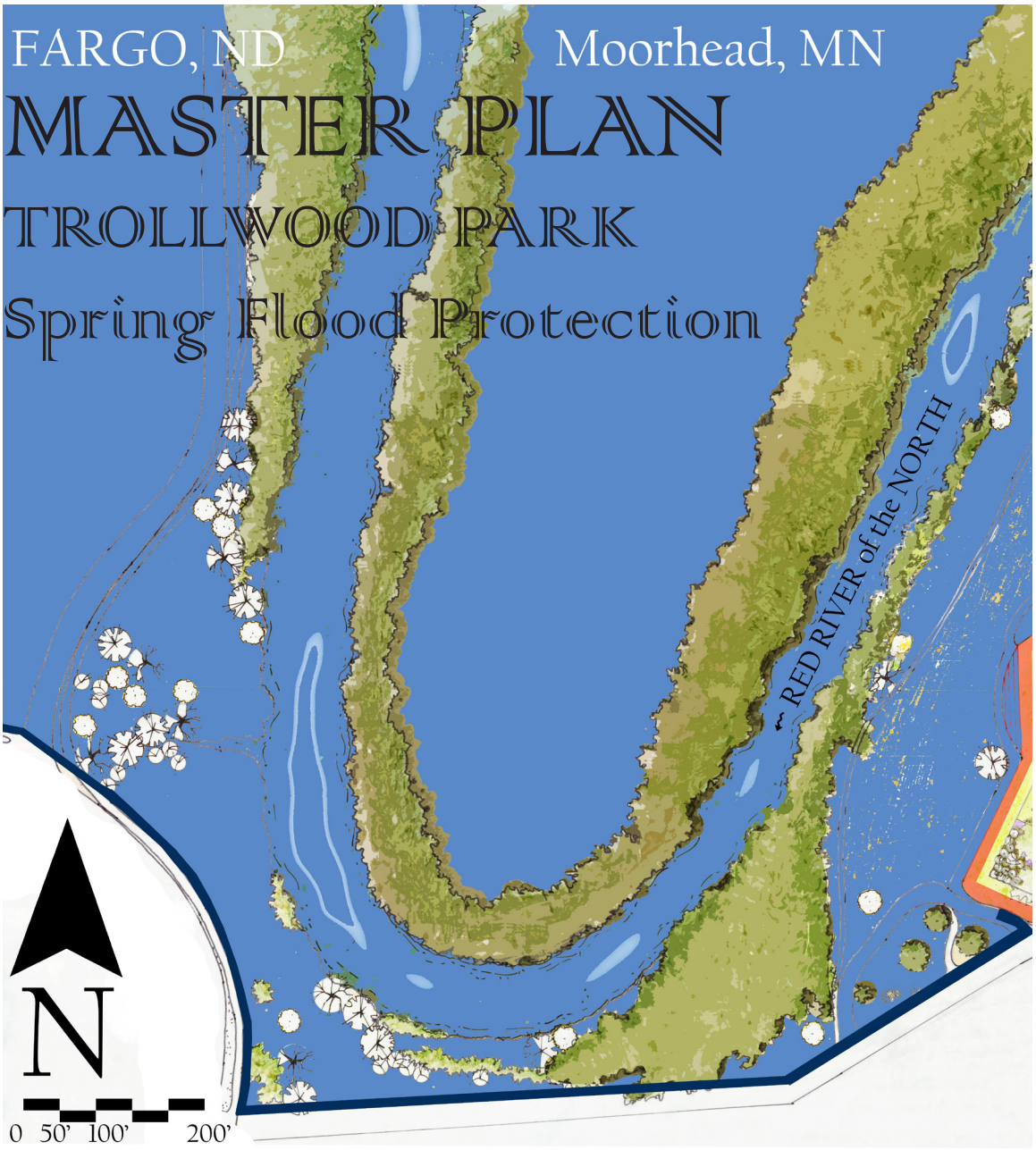
MASTER PLAN

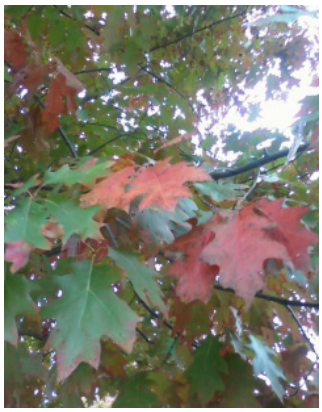
TROLLWOOD PARK

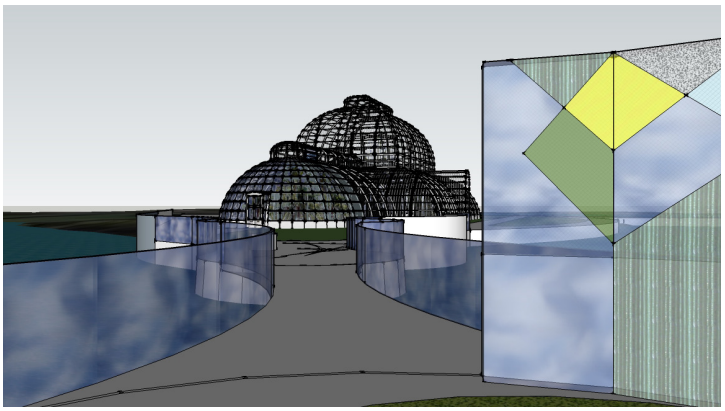


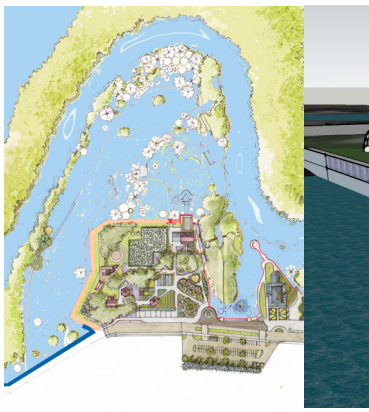

RED RIVER of the NORTH
Tallgrass Prairie
The
Meadow
The
Fen



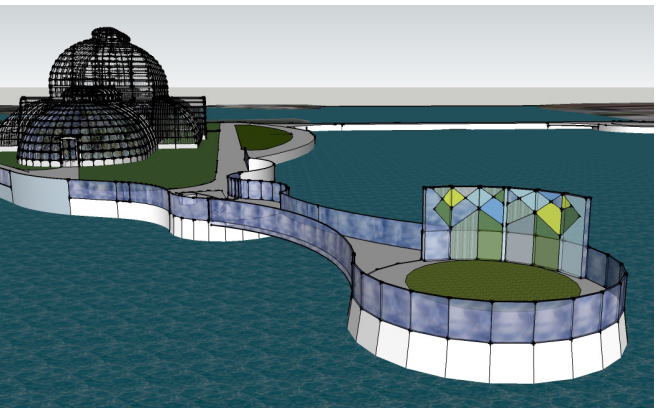

FARGO, ND
Moorhead, MN
MASTER PLAN
TROLLWOOD PARK
Spring Flood Protection
RED RIVER of the NORTH
N
0 50' 100' 200'



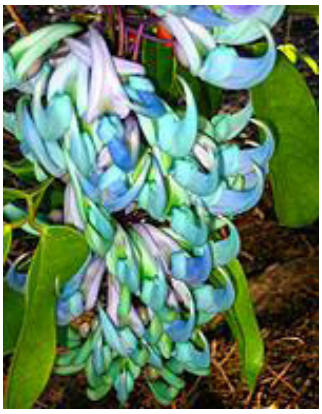




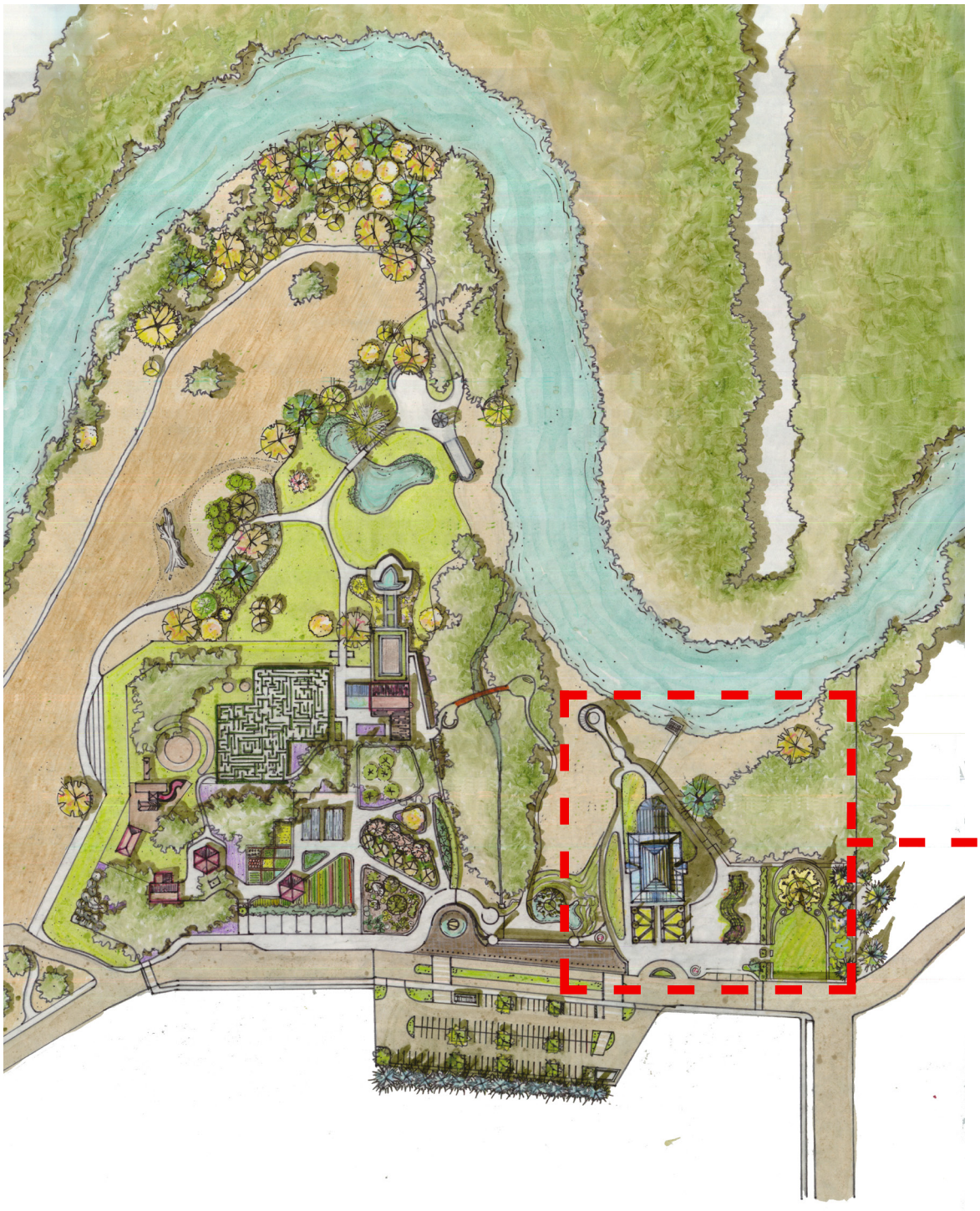

MN
RIVER of the NORTH



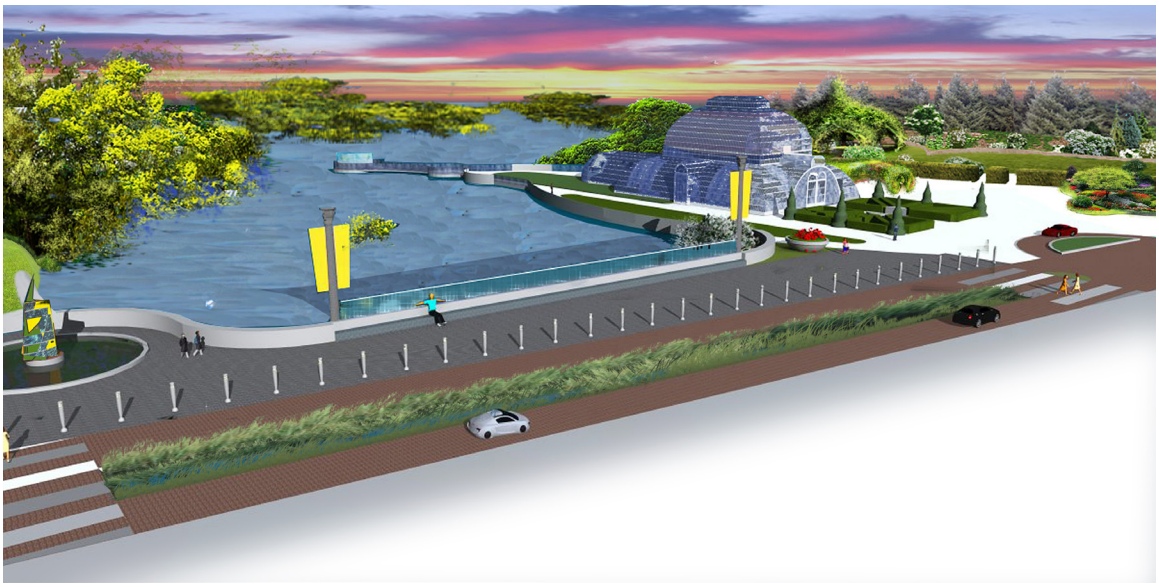

The Enchanted Garden
A Paradise for Butterflies



Design Elements: The Conservatory, Formal Gardens, Vine Collection and the Woven Willow Dome at the "White Room" outdoor Venue

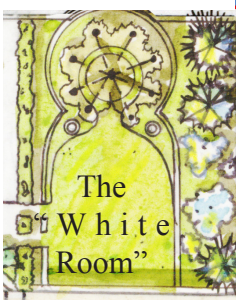


The Conservatory & Formal Gardens

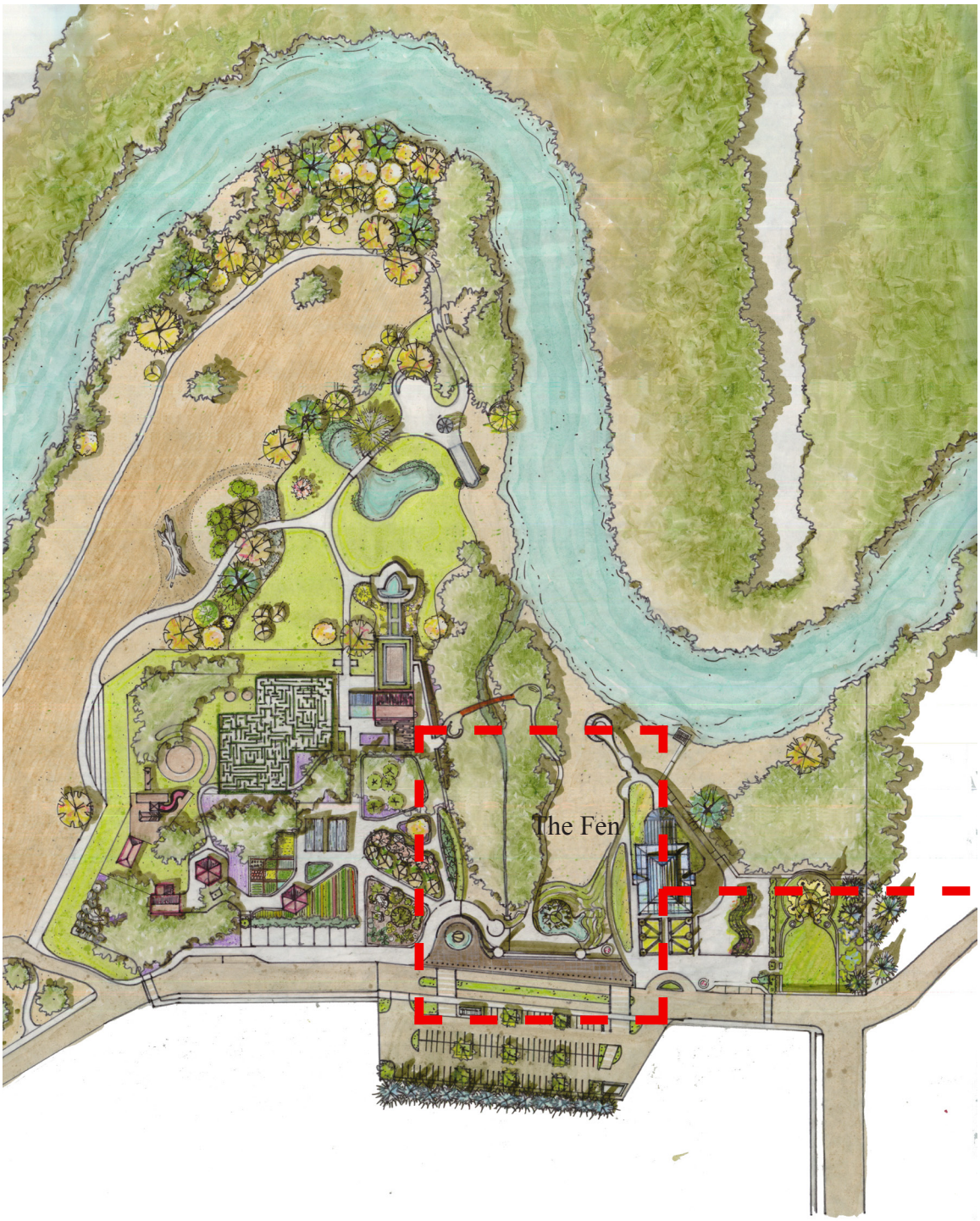


The Woven Willow Dome in the “White Room”, an outdoor rentable venue with only white flowered plants, for a neutral color pallette.

www.englishbasketry willows.com

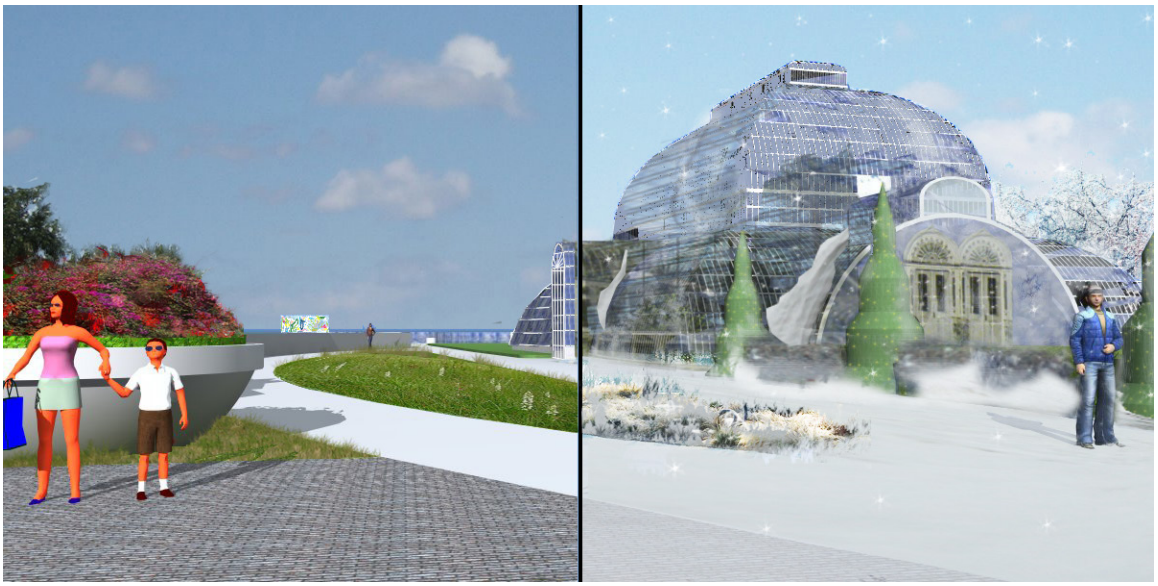


Design Elements: The Prominade, Fen and Native Orchid Habitat



The Promenade: Gathering Space and Pedestrian Circulation/Connection

The Bollards on the Prominade are powered by a colorful solar-panel sculpture



Native Orchids encircling the conservatory entice visitors Summer through Fall.
The Conservatory is a welcoming get-away during Fargo's famously cold Winters.

The Fen: Orchids and Native companion plants (clockwise from top right: Marsh Marigold [cowslip], Pussy Willow, Anemone, and Red Osier Dogwood)

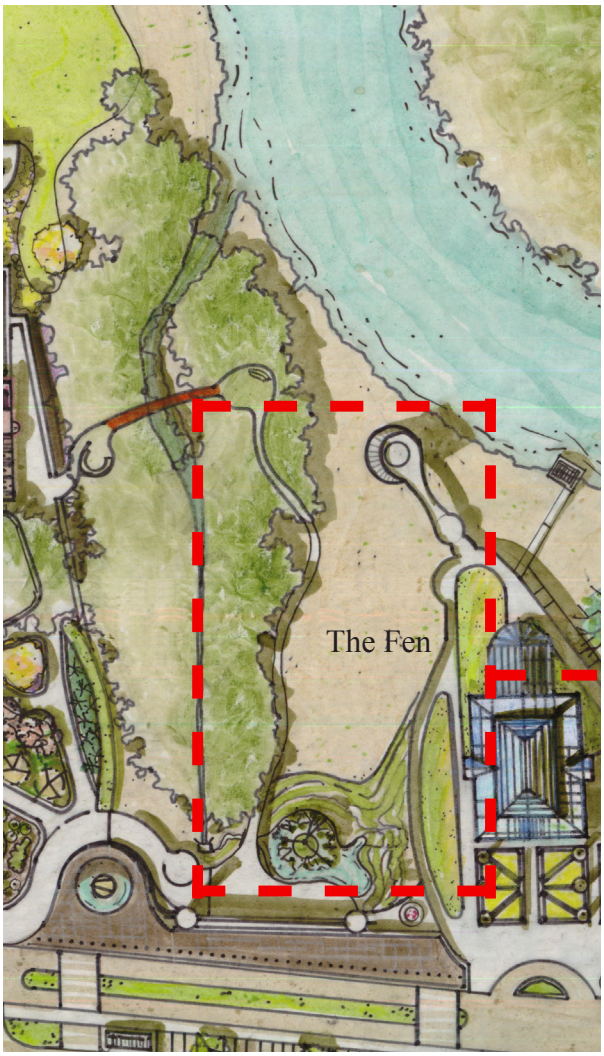


Photo: by Jodi Sagvold

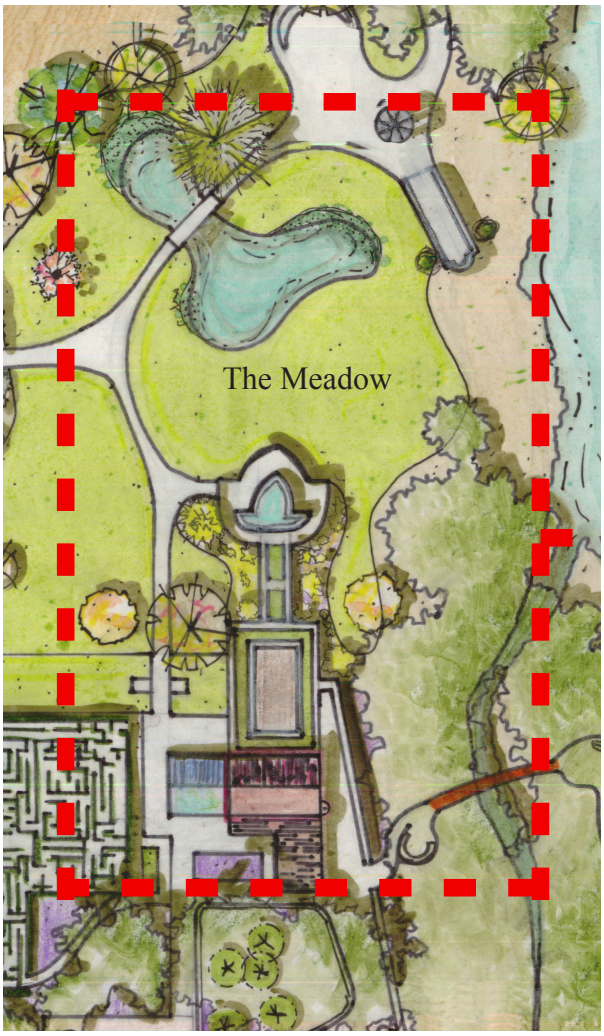
Photo: blog.2modern.com

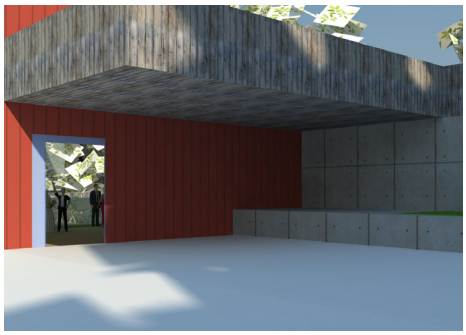
Photo: www.flickr.com

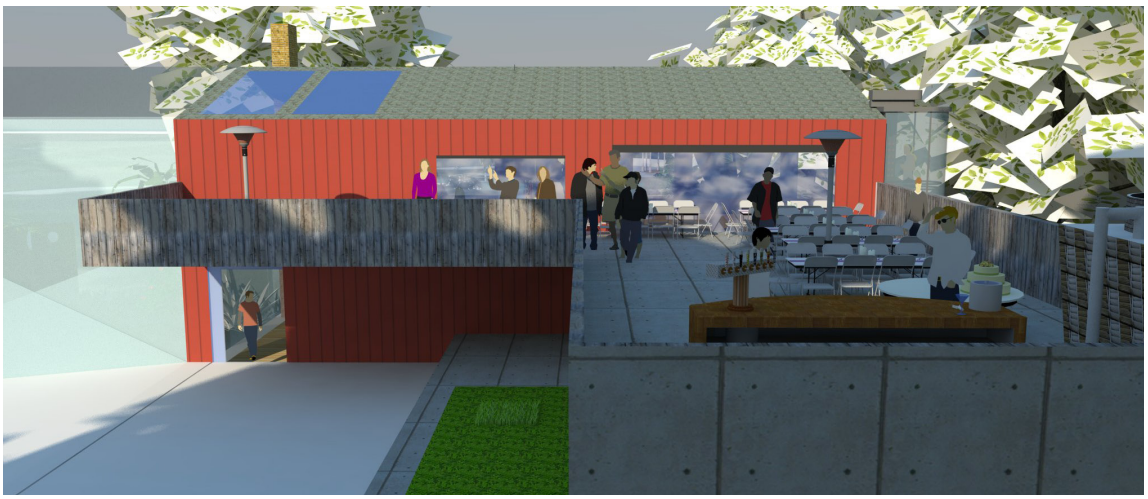
Photo: www.tripplebrook-farm.com

"Natural spaces and materials stimulate children's limitless imaginations and serve as the medium of inventiveness and creativity observable in almost any group of children playing in a natural setting"
(Louv 2008)

The Meadow: Rentable Venue Space

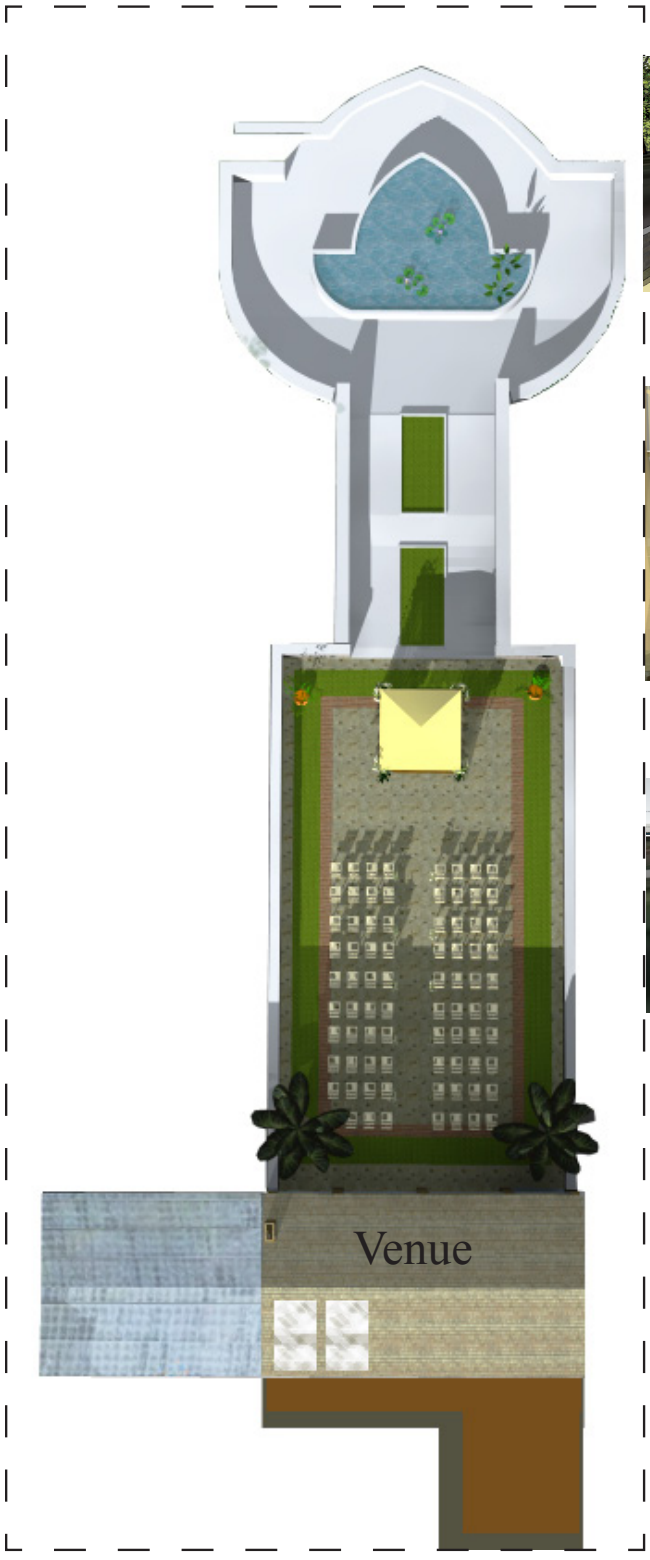


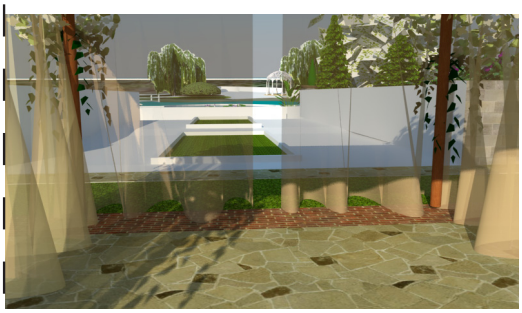




The Meadow: Rentable Venue Space

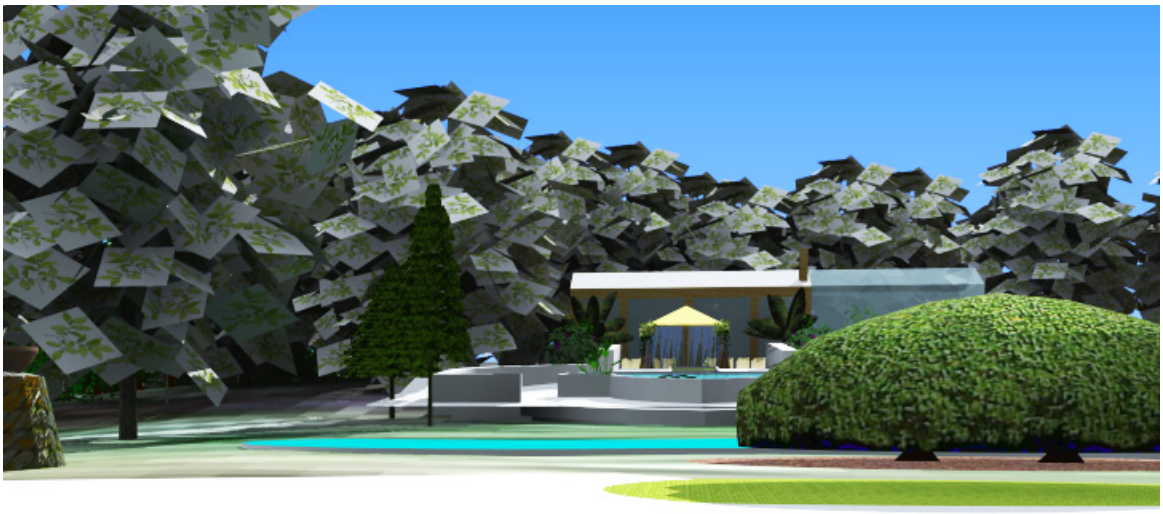
Restrooms, Kitchen, Glass Plant House, Water Lily Pond





The Setting: Wood, Water, Meadow ...

... Conservatory



Reference List:

Barbour, M.G., and W.D. Billings. 1988. *North American terrestrial vegetation.* Cambridge University Press, Cambridge, England.

Barbour, M.G. and Christensen, N.L. (1993). Vegetation. In Flora of North America Editorial Committee (eds), *Flora of North America north of Mexico. Vol. 1.* Introduction. Oxford University Press, New York. Pp. 97-131.

Brown, Paul M. (2006). *Wild Orchids of the Prairies and Great Plains Region of North America.* Gainesville, Tallahasse, Tampa, Boca Raton, Pensacola, Orlando, Miami, Jacksonvillie, Ft. Myers: University Press of Florida.

Centres of Plant Diversity. Web Site: http://www.botany.si.edu/projects/cpd/na/na.htm

Center for Plant Conservation. Web Site: http://www.centerforplantconservation.org/

Creating an Urban Wetland - Video (2007) Geonewmedia. www.geonewmedia.com

Cunningham, Anne S. (2000). *Crystal Palaces: Garden Conservatories of the United States*. New York: Princeton Architectural Press.

Davis, S.D., Heywood, V.H., Herrera-MacBryde, O., Villa-Lobos, J. and Hamilton, A. (eds.). 1997. *Centres of Plant Diversity: A Guide and Strategy for Their Conservation. Volume 3: The Americas*. IUCN Publications Unit, Cambridge, England. http://botany.si.edu/projects/cpd/

Environmentally Significant Areas of Alberta Volumes 1, 2, and 3.(March 1997) Prepared by: Sweetgrass Consultants Ltd. Calgary, AB for: Resource Data Division Alberta Environmental Protection Edmonton, Alberta. Web Site: www.tpr.alberta.ca/parks/heritageinfocentre/environsigareas/docs/esa_ab_vol1.pdf

GreenSource, the magazine of sustainable design. Web Site: http://greensource.construction.com

Goodall, David W., & Gore, A.J.P. (1983). *Ecosystems of the World -4B, Mires: Swamp, Bog, Fen and Moor*. Amsterdam, Oxford, New York: Elsevier Scientific Publishing Company.

Kirkwood, Niall. (2001). *Manufactured Sites: Rethinking the Post-Industrial Landscape*. London & New York: Taylor & Francis Group

Koppelkamm, Stephan. (1981). *Glasshouses and Wintergardens of the Nineteenth Century*. New York: Rizzoli International Publications, Inc.

Louv, Richard. *Last Child in the Woods: Saving Our Children from Nature-Defecit Disorder*. Workman Publishing: New York, 2005

Morin, Nancy R. & Spellengerg, Richard W. (2008). *FLORA OF NORTH AMERICA*. Flora of North America Project. Web Site: http://www.fna.org/history

N. Morin 1995, www.centerforplantconservation.org

North Dakota Department of Health website, www.ndhealth.gov

Northern Prairie Wildlife Research Center Online
http://www.npwrc.usgs.gov/resource/habitat/climate/wind

Ransom County ND Website, www.ransomcountynd.com

Roscoe, Robert. (March-April 2002). *Natural Environments: Twin Cities Metropolitan Area*, Architecture Minnesota Journal, Vol. 28 No. 2. Publisher: Beverly Hauschild-Baron, Hon. AIA

USGS Northern Prairie Wildlife Research Center www.npwrc.usgs.gov

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Hometown: Sheldon, North Dakota

NDSU's new downtown facilities are a great addition to an already great Landscape Architecture program.

Presentation Boards

HABITAT

Two of North Dakota's native Butterfly species are currently in decline. Both are facing loss of habitat as tallgrass prairies and oak savannahs are converted to other uses such as agriculture and urban expansion. Both of these butterflies depend upon a particular plant specie for its' survival.

The Trollwood site offers opportunities to provide habitat for both while acting as a seed bank for native grasses and violets necessary for their survival.

URBAN ENDEMICS PROTECTING IMPERILED SPECIES

Jodi Sagvold
LA 572 - Landscape Architecture Thesis
Spring 2011, NDSU, Primary Advisor
Jason Kost

TROLLWOOD PARK, FARGO, ND

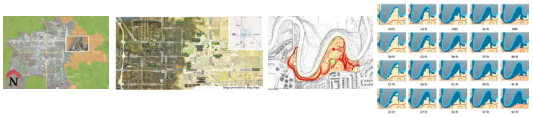
SITE LOCATION

When Congress authorized the Endangered Species Act, they declared that species of "fish, wildlife, and plants are of aesthetic, ecological, historical, recreational and scientific value to the Nation and its people."

The intent of this law was not simply to develop a list of species in danger of extinction, but to develop plans that would recover populations of these species to a point where they could be removed from the list.

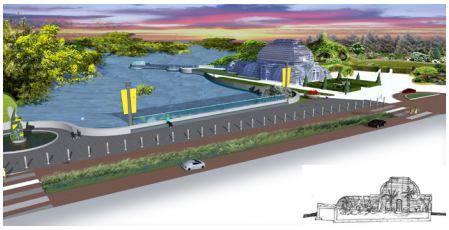
www.npwrc.usgs.gov

Software Used: InDesign, Sketch-Up, IDX
Renditioner, Photoshop, Google Earth, Google Maps,

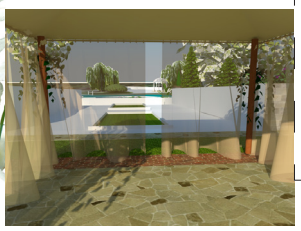


The official flood stage of the Red River at Fargo is 18'

2009's record setting crest was 40.84'



Designed for year-long use, The Trollwood Botanic Garden not only offers great views of Spring flooding on the Red River of the North, but provides a warm retreat for escaping Fargo's famously cold Winters,



"The Meadow" can be rented out for special occasions and contains both indoor and outdoor gathering spaces, A large second-story Deck and indoor balcony overlooking the Great Room, Kitchen, Restrooms, Room Temperature glass plant room, and large fireplace.

View from the Meadow looking back at the Conservatory and Red River.

Above: Early modeling showing the conservatory with high water line at 45 feet.